FINAL REPORT

RESEARCH ON MINORITY/DISADVANTAGED SUPPORT PROGRAMS

Prepared by

GEORGETOWN UNIVERSITY SCHOOL OF MEDICINE
Washington, DC

for the
Department of Health and Human Services
Health Resources and Services Administration
Bureau of Health Professions
Division of Disadvantaged Assistance

(Contract #240-93-0038)

August, 1995

MH99D3910

MH99D3910

ACKNOWLEDGEMENTS

The project staff of Georgetown University thanks Mr. William Holland, Acting Director and Ms. Ernell Spratley, Project Officer, Division of Disadvantaged Assistance, Bureau of Health Professions, Health Resources and Services Administration, for their support and technical insights throughout the initiation of this research and the preparation of the final report. Appreciation is also expressed to Dr. Clay E. Simpson, Jr., Deputy Assistant Secretary for Minority Health, for his support and guidance during the early stages of this project.

A significant contribution to the analysis was made by the HCOP Work Group (HWG). Each of the HWG participants represented initiatives that have made major contributions to the field of supplemental educational programs for minority/disadvantaged students. The insights and programmatic expertise they contributed to this research provided direction and helped build an effective analytical base for the final report. A full listing of the Work Group membership is included under Appendix #01.

The success of information gathering and the ultimate presentation of findings was the result of substantial contributions made by technical consultants Diana Day and James Barnes, PhD., President of Human Systems Management and Development Corporation.

The information and findings assembled in this final report are the product of the cumulative efforts of the project team at Georgetown University School of Medicine. Individuals who had primary responsibility include Arthur Hoyte, MD, Principal Investigator for this research and Director of Georgetown University School of Medicine's Office of Minority Student Development; and, David L. Taylor, Senior Research Fellow and Janet Perkins, Program Evaluation Expert, the research and evaluation team who developed the analysis and prepared the final report. Special acknowledgement is noted for the conceptualization and quantitative analytical contributions of Aftab Hassan, PhD., nationally recognized specialist in educational programs evaluation.

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EXECUTIVE SUMMARY

RESEARCH ON MINORITY/DISADVANTAGED SUPPORT PROGRAMS

Over the past twenty years of its existence, the **Health Careers Opportunity Program** (HCOP) has facilitated the entrance and graduation of thousands of minority/disadvantaged students into health professions schools. Between 1990 and 1994, an average of 8,600 students (nation-wide) participated in HCOP each year. Approximately 20 percent of these students attended post baccalaureate programs. Since HCOP's initiation, on an average, 70 percent of its program participants who applied to health professions schools have been successful in gaining admission.[1]

As the result of shifting political and economic priorities, new issues, barriers and limitations have arisen for HCOP-funded programs. Factors such as health care reform are causing a ripple effect throughout the health care system. As hospitals and health agencies scale back their operations, fewer slots are available for residencies and entry level health professional positions. In response to this reality and in conjunction with shifting perceptions of the need for affirmative action programs within the current market environment, prospective minority/disadvantaged health professions school applicants are facing increasing competition for a decreasing number of slots. As a result, indications point to the fact that while the number of minority/disadvantaged students applying to, and graduating from, health professions schools has significantly increased[2], the ratio of applicants accepted and successfully graduating, relative to the total number of applicants, has actually decreased[3]. These are some of the key issues and challenges facing HCOP and prospective minority/disadvantaged health professions students. This report has been prepared to:

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[1] Thomas, S. (1994) " After Two Decades, HCOP Continues to Create Opportunities In Health," Black Issues In Higher Education. 18-19.

[2] Association of American Medical Colleges (1995) Project 3000 by 2000, Progress Report. 1-42.

[3] Whitten, Charles. (1991) Proceedings of the First National Postbaccalaureate Programs Conference

- identify HCOP participant selection variables that can be useful in matching minority/disadvantaged students with the HCOP approaches most likely to help them to become more competitive, especially in light of increasingly more difficult health professions school acceptance criteria;

- highlight effective programming and educational interventions that have resulted in statistically improved course grades and higher levels of retention of at-risk minority/disadvantaged students within the health professions schools; and,

- research the barriers which discourage minority/disadvantaged students from participating in the sciences (see Vol II Report, Literature Search on Minority/Disadvantaged Support Programs).

Our goal is to provide HCOP managers with strategies and tools that can be useful in designing future interventions based on proven approaches that will positively effect the number of minority/disadvantaged students each year, who are accepted into health professions school and graduate in a timely manner. Additionally, this research has led to the identification of tracking and valuative processes to maximize the impact of limited HCOP resources. The analyses presented in this report reflect information gained through an expansive literature search, thorough examination of progress reports provided by the Division of Disadvantaged Assistance (DDA) and the recommendations of the HCOP Work Group (HWG) [see appendix 1] which was established in support of this research effort.

CHAPTER I, Introduction encompasses background information on the issues facing minority/disadvantaged representation in the health professions. This chapter details the role of federal support programs, such as HCOP, in increasing these numbers. Also detailed in this section are the 'questions addressed' (and objectives) through this research and the methodology used to address them. The objectives of this analysis, as defined in the "Scope of Work," involve: 1) characterize those factors which dissuade minority/disadvantaged students from pursuing science programs and contribute to high drop out rates[4], 2) based on the review of current and previous HCOP interventions, identify effective learning strategies which can be replicated/adapted at other locations; and, 3) develop selection criteria/indicators which can be utilized by HCOP projects to select those students most likely to succeed as the result of federal support programs like HCOP. The literature review which was completed prior to the development of this report, provides a preamble for the initiation of HCOP and HCOP-type interventions. For example: the Association of American Medical Colleges' Project

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[4] Georgetown University (1994) Literature Search on Minority/Disadvantaged Support Programs.

"3000 by 2000,"[5] calls for the development of several national networks and databases to track programs (as well as individual students) that can help identify a critical pool of minority/disadvantaged candidates for health professions training. To complement this and other efforts, the National Science Foundation's Urban Systemic Initiative is focused on producing dramatic reform in the delivery of math and science instruction at the secondary school level, which should supply the health professions "pipeline" with increasing numbers of well-prepared minority high school graduates.

These approaches, however, do not necessarily respond to the immediate and intermediate need for more minority/disadvantaged health profession school students. The research findings support the need to continue the supplemental learning and academic enrichment efforts funded by the Health Careers Opportunity Program (HCOP). The information presented within this report indicates that many of these programs have provided the critical element of assistance needed to facilitate the increased success of minority/disadvantaged students in entering into and graduating from, health professions schools in a timely manner.

The subsequent chapters of this report will present a profile of selective HCOP project activities, present insights into their effectiveness and opportunities for enhancement of the over-all program. Each chapter concludes with a list of recommendations which correspond to proposed guidelines. The following chapters of this report will detail:

- **Chapter II**, Effective Learning Approaches: 'Improving Cognitive Skills' in Minority/Disadvantaged Student Populations

- **Chapter III,** Selection of the HCOP Participants

- **Chapter IV,** Assessment of HCOP Project Data

- **Chapter V,** A Sampling of Interventions Designed to Improve the Competitiveness of Minority/Disadvantaged Students

- **Chapter VI,** Comprehensive Listing of Recommendations, Related Guidelines and Rationales

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[5] Association of American Medical Colleges (1995) Project 3000 by 2000, Progress Report. 1-42.

KEY RECOMMENDATIONS

Based upon the research and deliberations by the HCOP Work Group, the following RECOMMENDATIONS could provide a foundation for HCOP to build upon its success in significantly increasing the numbers of underrepresented minorities providing health services.

#1 **Encourage all HCOP Grantees to incorporate HCOP in their program name/title, in a manner which is appropriate within the context of their individual projects. At the same time, empower HCOP student participants as partners in the program by formally designating them as "HCOP Fellows."** There is an urgent need for Grantees to develop practices that better enables students, advisors and resource allocators to know that HCOP provides funding and technical support for the program. The empowerment concept is needed both to increase opportunities for HCOP participant (student-specific) level tracking throughout their health professions educational development and to expand options for measuring outcomes. It is additionally needed to enhance participant self-perception of HCOP students and to entrust them with responsibility of continuing their association with HCOP once they have completed the program.

#2 **Encourage HCOP Grantees to utilize both cognitive and non-cognitive variables as a basis for the selection of HCOP participants and the matching of those participants to the programs which are most likely to benefit them**. This is needed to provide a more representative assessment of each applicant's relative academic risk and to ensure that participants are matched with the programs that are most likely to benefit them.

#3 **DDA should develop a "universal minimum data set" (as discussed in Chapter IV) applicable to most college and health professions school HCOP programs which includes both cognitive and non- cognitive variables. DDA should additionally encourage programs to include questions in all participant applications which will elicit the necessary data.** This is needed to ensure the availability of reliable comparable data which can be used to accurately assess HCOP's impact both locally and nationwide, and, to identify truly effective models.

#4 **Encourage HCOP Grantees to become familiar with collaborative learning approaches, to use them in a way that can best be supported within their existing resources, and, are most appropriate in meeting the needs of their participants.** This is needed in light of the research and analysis presented in this report which indicates that collaborative learning is effective in improving cognitive skills and non-cognitive attributes.

#5 Support the **establishment of a "National Student Academic Enrichment Match Service Center," within the private sector, which will attempt to match a student's aspirations (medical school, dental school etc), academic profile, existing financial circumstance, grade level and geographic location, with the curriculum and support service programs or courses which best address his/her needs.** The activity recommended would not require a complicated operational program in order to provide assistance to students and their advisors. This service is urgently needed since students are not in a position to effect such matches on their own, and currently, the available information on programs does not allow students to identify programs that hold the most promise of responding to his/her needs.

#6 **Establish a Standing Guideline and Diagnostic/Intervention Review Committee which includes, to the extent possible: a) HCOP Grantee staff b) recognized, technical experts in student testing, c) known authorities on cognitive learning strategies and d) program evaluation specialists.** The Committee could provide a source of technical assistance consultants which the programs and their institutions could employ to assist in the design and maintenance of their efforts.

#7 **Encourage the establishment of a private sector based "Data Exchange Clearing House" which compiles, analyzes and disseminates reports related to data on program interventions and outcomes. This information will better enlighten HCOP grantees about the cognitive and non-cognitive factors that contribute most to the success of HCOP funded programs in aiding minority/disadvantaged students to become more academically competitive for health profession school entry, retention and graduation.** Even tough intuition suggests many of the approaches may be effective, there is a need to confirm these beliefs with hard data. Such a confirmation will necessitate HCOP funded programs working cooperatively and systematically together to compile and subsequently analyze the cognitive and non-cognitive variables which influence academic performance.

#8 **DDA should encourage the development of a tiered academic enrichment system that provides highly motivated, minority/disadvantaged students an opportunity to cultivate their cognitive skills under guidance over time. In addition, DDA should support the establishment of at least one tiered program specializing in cognitive skill development within each region of the United States.** The focus on developing and institutionalizing tiered relationships can ensure that skills development does not end at the door of an individual project.

Chapter II focuses on learning strategies, particularly those that incorporate collaborative learning, such as "Supplemental Instruction" (SI) and Video-based assisted learning. These strategies are highlighted in this report because they have demonstrated their effectiveness in improving cognitive skills and in enhancing the rate of acceptance and timely graduation of minority/disadvantaged students from health professions schools. A justification is included which substantiates the identification of "Collaborative Learning" as an umbrella approach that evolved from Piaget's[6] research on cognitive thought skills development and Karplus'[7] "Learning Cycle" which applies Piaget's conclusions within the context of the American educational system. Included in this section is an overview of the categories of interventions which have statistical data supporting their effectiveness. This is followed by an explanation of the methodology for selecting the Project Summaries which are presented in *Chapter V*. Lastly, the Findings and Recommendations section of this chapter will provide insight into the design of future HCOP interventions.

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[6] Jean Piaget, a 19th century Swiss psychologist and philosopher.

[7] Robert Karplus, PhD., a contemporary professor of math and physics at the University of California at Berkeley.

Findings on Intervention Model

Nearly all HCOP funded programs provide some type of cognitive skills development support to participants. Most commonly, cognitive skills development is encompassed in the generic course designations of a study skills class and/or reading class and/or problem-solving class. An analysis of 48 projects in the 1994 Final Report on the Evaluation of HCOP Summer Programs[8] revealed that on average, only 6 hours out of the general 40 hours per-week program schedule is dedicated specifically to the development of cognitive skills which make the student more highly competitive in all science classes, as well as, in standardized test-taking (MCAT, SAT, etc..). Moreover, the cognitive skills instructors are often special consultants and their efforts are not directly linked to the science-based course work which comprises approximately 26 hours of the weekly program schedule.

In recognition of the need to emphasize the integration of cognitive skills development (eg. critical thinking, problem solving and reading comprehension) activities with science-content education (eg. course lectures), several HCOP-funded projects have designed approaches with this goal in mind. One summer program which has received well deserved attention for its capability to nurture content mastery and cognitive skills development is Project SOAR (Stress on Analytical Reasoning). SOAR, however, is the last step in a sequence of summer programs which starts the summer prior to entering the 10th grade of high school and ends the summer prior to entering the freshman year of college. Students may elect to participate in one or all steps of the sequence. The intent of the program is to provide students with a "step-up" progression of academic enrichment experiences. This approach is consistent with the position that cognitive skills development efforts are most effective when in force over long spans of time within a structured, supportive environment.

Summer programs and short term skills building activities can be an ideal setting to "plant" the foundation of a cognitive skills development process to be nurtured in an integrated, organized environment. These cognitive skills will continue to improve if practiced over time, preferably under-monitored conditions. For example, a facilitator-led interactive small group learning format is an excellent vehicle for monitoring the cultivation of cognitive skills. Thus the findings of this contract strongly suggest that program staff should be aggressive in educating students that their participation in short term program activities is part of a longer term process.

Based upon literature and HCOP progress report reviews, HCOP funded programs that are highly structured, and operate throughout the academic year (eg. postbaccalaureate programs), appear to have the greatest success in improving cognitive skills, facilitating participant entry and fostering minority/disadvantaged student retention in health professions schools. This category of program is consistent with the position that content mastery and cognitive skills development demand time and are best nurtured in environments in which the skills can be applied within the traditional curriculum during the academic year.

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[8] Houston Associates, Inc. (1994). Evaluation of the Health Careers Opportunity Program Summer Programs.

The HCOP funded programs that best meet this challenge are academic year programs that emphasize the integration of cognitive skills building activities within a knowledge-based curriculum. A number of HCOP funded, post-baccalaureate programs fall into this category. They have had a significant impact on improving the academic competitiveness of minority/disadvantaged students entering health professions students. Current and past HCOP-funded post-baccalaureate programs such as the 13 "Preference Programs"[9] that received HCOP preference funding in FY90; and older programs such as Southern Illinois University, Wayne State University, Creighton University, and Georgetown University have demonstrated the success of HCOP interventions[10]. As discussed in **Chapter 5**, these and other post-baccalaureate programs have been very successful in facilitating the entry and timely graduation of minority/disadvantaged students.

Recommendations:

The following recommendations have an excellent chance of being well received by HCOP grant applicants because they place emphasis on approaches either currently being used by some HCOP grantees or, on methodologies originally developed with HCOP financial support.

#1 Encourage grantees to implement learning approaches that have been shown to be statistically effective in improving student comprehension and conceptual understanding of lectures and textbook material.

#2 Encourage all grantees to become familiar with collaborative learning approaches; and, to adopt those approaches which can best be supported by their existing resources and are most appropriate for the students targeted by their program.

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[9] The Health Careers Opportunity Program announced a funding preference for 13 targeted post-baccalaureate program grants for the FY90 grant cycle: 9 for allopathic medicine, 1 each for dentistry and podiatry, and 2 for allied health.

[10] Proceedings of the First National PostBaccalaureate Programs Conference, Columbus, Ohio, March 4-5, 1991.

#3 DDA should minimally earmark funds to support at least one Grantee in each region that has as its objective the improvement of the HCOP participant's scores on the science and math portions of standardized tests; and, makes a commitment to use collaborative learning approaches to improve basic arithmetic operations.

#4 Grantees should be encouraged to sponsor reading interventions that emphasize evaluation, application, and the incorporation of new information.

#5 Grantees should be encouraged to sponsor writing interventions that emphasize addressing the challenges that have been incorporated in the writing section of the MCAT (i.e. to define the given statement as thoroughly as possible, to explore the meaning of the given statement by giving a contradictory example and to discuss ways to resolve the conflict between the initial statement and the contradictory example).

#6 Grantees should be encouraged to implement activities in HCOP programs to cultivate non-cognitive skills, such as realistic self-appraisal and positive self concept.

#7 Establish a process by which HCOP program participants will leave the program with diagnostic results, specific information about the programs learning approaches, outcome performance and recommendations designed to enhance future development of cognitive skills.

Chapter III looks at the issues surrounding the Selection Criteria for use in identifying participants for HCOP-funded projects. This section begins with the Identification of Terms and Cognitive/Non-Cognitive Indicators utilized in the targeting of students likely to benefit most from a HCOP education intervention. The chapter continues by drawing upon findings that surfaced from the literature search, the HCOP Work Group (HWG) and the review of the HCOP-Progress Reports[11] to show correlations between Cognitive/Non-cognitive Indicators and performance in science courses and on standardized exams (eg. Scholastic Assessment Test, Medical College Admission Test and United States Medical Licensure Examination). Special attention is focused on indicators that may reduce, what the HWG considers, the excessive emphasis that health professions schools place on minority/disadvantaged student performance on standardized tests. Finally, Recommendations are provided on which criteria appear to be the most effective in selecting students.

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[11] The Division of Disadvantaged Assistance selected 44 HCOP Progress Reports that reflected the activities of 10 individual projects.

Findings on Participant Selection Process

The literature is filled with studies showing that undergraduate cumulative grade point averages (UCGPA) and undergraduate cumulative science GPAs (UCSGPA), together with physical and biological science MCAT sub-test scores, have statistically significant correlations to successful performance in medical school basic science courses.[12] [13] Few of these studies had a particular focus on minority students. However, in a 1986 study conducted at Howard University, an historically black university, similar results were also reported for its largely minority student population[14]. One possible explanation for the similarity of results may rest with the fact that Howard's medical school student body (as is true for all medical schools) has a significantly homogenous cognitive profile.

It is notable that the majority of educational research focusing on minority health professions students has been conducted at predominantly white schools. Sedlacek and Prieto assert that cognitive variables alone (grade point average, standardized tests, course grades) are not the best predictors of academic success for minority students.[15] Their research indicates that non-cognitive attributes such as realistic self-appraisal and positive self-concept taken with selective cognitive variables (such as GPA and SAT) provide additional insights into the learning strategies of minority students, and in turn, their potential success in various academic curricula. Sedlacek and Sternberg suggest that minority students develop and foster learning behaviors to deal with different societal challenges, such as cultural barriers, which majority students have not commonly experienced. It is these additional adaptive learning strategies which can contribute to a minority student's ability to succeed in the university environment. Moreover, in deference to the importance of the non-cognitive variables in predicting the performance of minority students, the AAMC admissions committee has sponsored several workshops emphasizing this finding over the past two decades.[16]

The HCOP progress reports as well as the comments expressed by the HCOP work group participants support the philosophy that non-cognitive attributes should play an important role in the assessment of the relative academic risk for individual minority/disadvantaged students. However, even though many programs have collected non-cognitive data, few have analyzed the non-cognitive data as a basis for predicting levels of academic risk.

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[12] Association of American Medical Colleges, (1994). Validity Study

[13] Brooks, Michael and Jackson, James. (1981). "Validity of the New MCAT for Predicting GPA and NBME Part I Examination Performance". Journal of Medical Education. Vol 56, pp 767-769.

[14] Anderson, J. and Mitchell, K. (1986). Pre-admission Data and Medical Performance For Black Medical Students, from paper presented at AAMC conference.

[15] Sedlacek, W. and Prieto, D. (1990) "Predicting Minority Student Success in Medical School," Academic Medicine. 65(3) 161-66.

[16] Sedlacek, W. and Prieto. (1982) "An Evaluation of the Simulated Minority Admissions Exercise," Journal of Medical Education. Volume 57

Our research led to the hypothesis that a more structured and controlled application of cognitive and non-cognitive selection criteria for minority/disadvantaged students will provide an insightful and comprehensive profile of indicators useful in determining a student's level of relative academic risk. Within the context of knowledge about the curricula of health professions schools, the profile should provide a strong foundation for determining which minority/disadvantaged students, among the applicant pool, are most likely to be accepted into health professions schools and graduate in a timely manner, with the assistance of a HCOP funded intervention.

Findings relating to the role of cognitive and noncognitive variables in predicting academic performance must be considered when measuring risk levels. Unfortunately, terms such as "academic risk" and "marginal" student are not clearly defined. They often have different meanings from one HCOP grantee admissions committee and/or health professions admissions committee, to another. The research underscores how "risk" and "marginal" tend to be determined as frequently by internal institutional or program factors as it is by student cognitive and non-cognitive profiles. The plethora of the factors that come to bear on defining "academic risk" suggests it would be fruitless to try to develop a definition of "academic risk" that would be "universally" acceptable to HCOP programs and/or to health professions schools. Therefore, this report discusses how each HCOP program individually might attempt to quantify levels of student risk on the basis of the following characteristics and variables: 1) known health professions school barriers, 2) the program performance objectives, 3) the financial and non-financial resources available to support the HCOP program and, 4) the cognitive and non-cognitive profiles of the student applicants.

Once the participant variables are described, the report then discusses how cognitive and non-cognitive variables can be entered into formulae which has been generated through regression analyses. As a result, a project-specific HCOP Selection Index[17] is created that quantifies an applicant's relative risk level in terms which are significant to the individual program.

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[17] A sample Selection Index is included in the full report.

Recommendations

#1 Encourage HCOP Grantees to utilize both cognitive and non-cognitive variables as a basis for the selection of HCOP participants and the matching of those participants to the programs which are most likely to benefit them.

#2 Grantees should be encouraged to collect the "minimum data set" (discussed in Chapter IV) together with additional information from student applications, letters of recommendation, by telephone or personal interview and when possible by means of pre-admission cognitive and non-cognitive assessment tests.

#3 While Grantees should be encouraged to use non-cognitive variables in conjunction with cognitive variables, they should be strongly cautioned on how best to apply this information within the emotionally charged context of the student selection process.

Chapter IV explores the issues, barriers and limitations of the data collection efforts, implemented by past and present day HCOP projects. An underlying objective for all HCOP funded programs is to assist minority/disadvantaged students in demonstrating a level of knowledge and cognitive skills that will make them competitive for health professions school acceptance and graduation. Few question the fact that HCOP funded programs have been associated with an impressive increase in the number and percentage of minority/disadvantaged students gaining admission to health professions schools. The challenge facing this review was in the assessment of HCOP Progress Report data and the directive to develop a comparative analysis which cut across programs. However, the data reported by each Grantee was largely presented in the aggregate. This factor made it difficult to identify the analogous variables necessary to generate an effective review.

There is great enthusiasm among HCOP Grantees about the prospect of developing guidelines and processes by which reliable, relevant student level and program data can be better compiled, analyzed and disseminated. It is apparent to all involved in this process that the generation of reliable analyses assessing the effectiveness of HCOP funded interventions will require the creation of large common data sets and statistical expertise.

Findings from Data Review

Review of the literature review and HCOP Progress Reports revealed that HCOP grantees collect data that varies greatly in terms of the amount, type and use. In addition, HCOP grantees utilize a wide variety of statistical reporting formats to describe participants and to support the claims pertaining to their effectiveness and general outcomes. The data reviewed for this research was most commonly presented in one or more of the following levels of analysis:

- Aggregate data
- Cohort data
- Student specific data

In understanding the applicability of project data to future programming efforts, these reporting levels might be viewed as part of a continuum of analysis useful in the ultimate identification of effective recommendations. The foundation of this process is in the collection of comparable indicators which can be used to statistically validate relationships between interventions and outcomes.

> Aggregate data is most often used to provide comparable assessments of programmatic impacts. It offers an easily interpretable, snap-shot of important program elements and is useful in communicating information on a broad spectrum of HCOP-supported strategies. However, this level of data does not demonstrate a clear cause-and-effect relationship between student profiles and program interventions.
>
> Cohort data presents information in groupings by like variables which are useful in drawing correlations between program participant skill levels and the application requirements of various health professions schools. Additionally, cohort data, consistently captured in like data elements lends itself to constructive comparative and impact analysis over the life span of individual HCOP-funded efforts. This level of analysis is critical in determining the transferability of a given intervention strategy.
>
> Student-specific data provides the greatest insights about the relationships between cognitive and non-cognitive variables, the interventions implemented to impact them and the resultant improvements in the skills these variables represent. This data is critical in the initial stages of intervention design in that an accurate needs assessment of the target student population will lead to an effective match of program activities and student needs. Caution, however, must be taken to ensure that student-specific data is kept confidential. This may be accomplished through the deletion of names and social security numbers from files and replacing this information with, for example, HCOP identification codes.

The HCOP Progress Report review indicated that HCOP projects most frequently reported data in the aggregate. However, the research findings support the desirability of collecting student level data. A more detailed presentation of these research findings, statistically validating the correlation between student specific data and intervention outcomes, will be described in Chapter 4 of this report.

Many HCOP grantees are limited in the type, quality and amount of student level data that they can collect. It is unlikely that these programs have direct access to course grades after the student completes the program and continues along the educational pathway. Thus, these programs cannot readily measure the impact of their interventions on actual academic year course performance. HCOP funded summer programs, in particular, will continue to have problems tracking the impact their interventions have on subsequent standardized test performance and health professions school acceptance, unless some tracking process is established that is cost-effective, formally structured and linked to other learning experiences.

The following recommendations are based upon the research findings and analysis:

Recommendations:

#1 Develop a common set of 'confidentiality' guidelines and encourage all Grantees to collect, analyze and disseminate student related data within the boundaries of these guidelines.

#2 Encourage Grantees to collect cognitive and non-cognitive data utilizing a limited number of assessment instruments that have been field tested and shown to produce outcome data that is valid for minority/disadvantaged students.

#3 Encourage Grantees to reflect the components of a "minimum data set" in the questions they include on their participant applications.

#4 Establish a HCOP Fellows Program that identifies the type of HCOP program; and also indicates how many different HCOP programs the a student has participated in. The encourage Grantees to use this information to enhance their ability to track and subsequently report on the academic progress of former participants as they progress through the health profession schools.

#5 Encourage Grantees to participate in a national program designed to better track the academic performance and the ultimate career path of former HCOP student participants.

#6 Grantees should be encouraged to track the academic performance of past participants and relate academic outcomes to the non-cognitive attributes defined while a participant in the program.

Chapter V provides a sampling of academic enrichment programs which have collected statistically viable data linking their intervention to the improved critical thinking, problems-solving, and standardized test-taking skills of the participants. For the purpose of this review, the programs highlighted in this section have been divided into two sections, Program Overview and Program Outcomes.

Approaches and Programs Highlighted:

- Stress On Analytical Reasoning (SOAR)
- Supplemental Instruction (SI)
- FirstPrep
- Georgetown Experimental Medical Studies (GEMS)
- Video-based Supplemental Instruction (VSI)
- The Mathematics Workshop Program (MWP)

Chapter VI is included to provide an easily reference to the recommendations incorporated throughout this review. Additionally, this section provides implementation guidelines for each of the recommendations and includes rationales to support suggested enhancements to HCOP operations.

Encompassed in the body of the full report are comprehensive discussions and analyses of HCOP Interventions, Participant Selection Criteria and Project Data, as summarized in this Executive Summary. Preparation of this report reflects the in-depth examination of HCOP Grantee progress reports, an extensive search of the educational literature, analysis of HCOP Progress Report data, and the deliberations of the HCOP Work Group.

CHAPTER I

INTRODUCTION

The challenging combination of inferior school systems, economic hardship and the desolation of family support networks has led to the reality of a significant minority population which is both economically and educationally, disadvantaged. In conjunction with this fact, according to the AAMC[1], while African Americans, Hispanics, American Indians and mainland Puerto Ricans constitute nearly 20 percent of the total United States population, until the 1990's they had consistently represented less than ten percent of the medical school matriculants.

Begun in 1972 as the Special Health Career Opportunity Grant (SHCOG) Program, the Federal educational initiative known today as the Health Careers Opportunity Program (HCOP) was authorized by Title VII, Section 787 of the Public Health Service Act, as amended by Public Law 100-607. Since the initiation of Title VII funding for minority/disadvantaged programs, the number of underrepresented minorities enrolled in health professions schools (HPS) has increased nearly 300 percent. Over the past twenty years of its existence, the Health Careers Opportunity Program (HCOP) has facilitated the entrance and graduation of thousands of minority/disadvantaged students into health professions schools.

From the literature, the data confirmed that minority students do have an interest in the sciences and in becoming health professionals (see Volume II of Final Report, Literature Search on Minority/Disadvantaged Support Programs). The fact that they remain underrepresented in these fields suggests that even today, minority students continue to encounter factors along the educational pathway that dissuade them from pursuing science and health careers or contribute to their drop out rate from the health science's pipeline.

The goal of this research effort is to offer HCOP managers additional means to counter some of the more significant factors that dissuade minority students from pursuing careers in the health professions. This effort offers HCOP managers some strategies and tools that can be useful in designing future interventions based on proven approaches that will positively effect the number of minority/disadvantaged students each year, who are accepted into health professions school and graduate in a timely manner. Additionally, this research has led to the identification of tracking and evaluative processes to maximize the impact of limited HCOP resources. The analyses presented in this report reflect information gained through an expansive literature search, thorough examination of progress reports provided by the Division of Disadvantaged Assistance (DDA) and the recommendations of the HCOP Work Group (HWG) which was established in support of this research effort. The information contained in this report responds to Tasks #12 and #13 of the research contract which mandates the compilation of all findings derived from this analysis into a Final Report.

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[1] Association of American Medical Colleges (1995) Project 3000 by 2000: Year Three Progress Report. 1-5

The questions addressed in this research contract are:

- If minority/disadvantaged students have the interest and motivation to pursue an education in the sciences, and,
- if financial constraints can be overcome (or set aside),
- then, what interventions are needed to ensure that a larger percentage of these students are successful in entering and graduating from health professions schools?
- What selection criteria are needed to ensure that the students most likely to benefit from these interventions are identified?
- How can these interventions be tracked and assessed over time so that those components which are the most effective can be replicated within other projects?

NEW CHALLENGES FACING HEALTH PROFESSIONS SCHOOL APPLICANTS

As a result of shifting political and economic priorities, new issues have arisen for HCOP-funded programs. Factors such as health care reform are causing a ripple effect throughout the health care system. Hospitals and health agencies are dramatically reducing their operations, and this 'down sizing' trend affects the number of slots available for residencies and entry level health professional positions. Thus, many health professions school applicants are facing increasing competition for a decreasing number of slots. Within this environment, HCOP-funded programs can continue to play a critical role in improving the competitive level of minority/disadvantaged HPS applicants.

Reformatting National Standardized Tests

As the ratio of the number of applicants/to the number of health professions school slots increases, the national standardized testing formats are also changing. In this regard, standardized tests such as the Scholastic Aptitude Test, Medical College Admissions Test, and United States Medical Licensure Examination are placing a greater emphasis on the test-taker's ability to digest and analyze detailed reading passages, and to respond to questions through a process of deduction and critical thinking.

Due to many of the societal and educational factors elaborated in Volume II (Literature Search on Minority/Disadvantaged Support Programs) of this report, national data indicate that a significant portion of educationally and economically disadvantaged students, many of whom happen to be minorities, continue to test lower on average than do most majority students. For example, Whitten's[2] research shows that mean MCAT scores of African American medical school applicants remained at approximately the same for the period 1981-1990, and were less competitive than those of the majority students.

The review of the literature prepared for this report leads to the following insights:

- First, priorities are increasingly focused on building a 'pipeline' of young minority/disadvantaged students who have developed the cognitive skills necessary to be competitive in an increasingly more challenging market for health professions school slots.

- Second, while the number of under-represented minority medical applicants and matriculants has increased, the academic profiles of these students, as indicated by their average GPA and standardized test scores, have not significantly improved. This may indicate that as competition increases for a more limited number of HPS slots (particularly in the fields of medicine and osteopathy), minority/disadvantaged students may not continue to show the level of success in HPS admissions that they have experienced over the last four years (see Appendix 2).

- Third, given these trends, and until the 'pipeline' begins to yield greater numbers of minority/disadvantaged students whose cognitive skills (critical thinking, problem solving) are more competitive, programs such as HCOP continue to play a critical role in providing resources in support of, a) the selection and matching of students to programs most likely to meet their skills development needs; b) quality programs which provide effective cognitive, curriculum-linked skills development for students (high school senior through HPS matriculants); and, c) academic year programs, such as the post-baccalaureate programs, which provide an environment for long term nurturing of skills.

THE HEALTH PROFESSIONS PIPELINE AND HCOP'S CONTINUING ROLE

Volume II of this report provides an overview of a several strategies designed to expand the number of minority/disadvantaged students in the health professions pipeline. For example: the Association of American Medical Colleges'– Project "3000 by 2000,"[3] calls for the development of several national networks and databases to track programs (as well as individual students) that can help identify a critical pool of minority/disadvantaged candidates for health professions training. To complement this and other efforts, the National Science Foundation's Urban Systemic Initiative is focused on producing dramatic reform in the delivery of math and science instruction at the secondary school level which should supply the health professions "pipeline" with increasing numbers of well-prepared minority/disadvantaged high school graduates.

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[2] Whitten, Charles F. (1991). Proceedings of the First National Postbaccalaureate Programs Conference. 86-96.

These approaches, however, do not necessarily respond to the immediate and intermediate need for increased numbers and more competitive minority/disadvantaged students at the end of the health professions pipeline. The research findings support the continuation of current programs such as the Health Careers Opportunity Program (HCOP). The information presented within this report indicates that many of these programs can provide the critical element of assistance needed to facilitate the increased success of minority/disadvantaged students in entering and graduating in a timely manner from health professions schools.

The subsequent chapters of this report present the findings and recommendations derived from the research which may provide a foundation for the enhancement of HCOP. Cited at the beginning of each chapter are those Tasks, dictated by the Research Contract, to which the analysis responds. Included in these sections is a description of each Task, as it appears in the contract Scope of Work. The following paragraphs summarize the key elements of each aspect of the analysis introduced in this report:

- *Chapter II*, **Effective Learning Approaches: 'Improving Cognitive Skills' in Minority/Disadvantaged Student Populations**

    This Chapter presents results of the analysis of various educational approaches studied in preparation for this report. The research, together with recommendations provided by the HCOP Work Group (HWG) and information gleaned from selected HCOP progress reports, presents insights on a spectrum of collaborative learning approaches. The approaches highlighted in this section of the report have been associated with improvements in cognitive skills as measured by increases in academic year math and science course performance. Chapter II reflects the product of Tasks #10 and #11 through the presentation of intervention approaches which have been identified as the result of the application of the evaluative methodologies.

- *Chapter III*, **Selection of the HCOP Participant**

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[3] Association of American Medical Colleges (1995) Project 3000 by 2000, Progress Report. 1-42.

This Chapter discusses the issues involved in the identification of students most likely to benefit from HCOP and the need for effectively matching student needs with the programs most likely to meet those needs. The recommendations provide a foundation upon which individual programs can develop participant selection indices which best suit their needs. In response to Tasks #6 and #8 of the Scope of Work, Chapter III presents proposed HCOP participant selection criteria, and approaches for program-specific application and testing of these criteria.

- *Chapter IV*, **Assessment of HCOP Project Data**
  Analysis of available HCOP project data, together with a review of the educational literature, points to a need for consistency, between HCOP projects, in the quality and depth of data collected. Reliable data provides the fuel for the selection of participants, the evaluation of interventions and the translation of quality models. This Chapter speaks to the issues surrounding the development and application of analytical methodologies in assessing the outcomes of previous and existing HCOP projects. The information illustrated in this section relates to the products requested under Tasks #5, #10 and #11.

- *Chapter V*, **A Sampling of Interventions Designed to Improve the Competitiveness of Minority/Disadvantaged Students**
  This Chapter presents a selection of programs and approaches which have shown statistically validated positive correlations between their intervention and minority/disadvantaged student college and Health Professions School achievement. This Chapter is a product of the literature review directive outlined under Task #2.

- *Chapter VI*, **Comprehensive Listing of Recommendation, Related Guidelines and Rationales**
  The last Chapter provides a comprehensive listing of all the recommendations, incorporated through out this report, into one concise reference guide. Included as well, are what the HCOP Work Group (HWG) believed to be the key guidelines which will serve as a 'road map' for the enhancement of HCOP efforts. Lastly, each recommendation is followed by a rationale detailing the history and goals which have supported the development of each suggested addition to the program. Chapter VI is a combination of the specific directive of Task #9 (the development of student selection guidelines) and the product of the full research effort.

CHAPTER II

Effective Learning Approaches: 'Improving Cognitive Skills' in Minority/Disadvantaged Student Populations

Chapter II reviews the learning interventions utilized by HCOP Grantees to improve the academic performance and retention of minority/disadvantaged students in health professions schools. This review is in concert with the goals of the Division of Disadvantaged Assistance (DDA) in identifying approaches most likely to effectively employ limited resources in assisting minority/disadvantaged students to become competitive for health professions school acceptance and timely graduation. As outlined in the introduction, this portion of the report addresses the deliverables as directed under Tasks #10 and #11 of the "Research on Minority/Disadvantaged Support Programs" project. These Tasks involve the development of methodologies for the assessment of HCOP funded intervention approaches and the subsequent analysis of these projects.

This review began under the directive to "analyze the effectiveness of specific intervention approaches in terms of their ability to improve problem-solving, reading, conceptualization, and test-taking skills." However, insights from the educational literature, grantee progress reports and the HCOP Work Group (HWG) revealed that the present compilation of HCOP project data does not provide a sufficient basis for the breath of analysis necessary to fully comply with the objectives delineated under Tasks #10 and #11. Three major factors inhibited this assessment:

- Measuring true gains in cognitive skills, such as problem-solving, is an extremely complicated task involving the interplay of a multitude of thinking processes. The intricacy of this interaction is effectively illustrated in Champagne's[1] "Taxonomy of Cognitive Skills." (see Appendix 3). Because of their complex nature, substantial gains in these skills areas are more likely to develop over time. As a result, it is difficult to assess the impact of short term interventions on long term cognitive skills development.

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[1] Champagne, Audrey. (1992). Cognitive Research on Thinking in Academic Science and Mathematics in (Halpern, Diane ed.) Enhancing Thinking Skills in the Sciences and Mathematics. Hillsdale, New Jersey: Lawrence Erlbaum Associates.

- HCOP project data were not configured in a manner to facilitate a statistically valid analysis of the impact of the approaches, both within a specific program and between programs. For example, because no minimum data set exists (such as the concept of a minimum data set presented in Chapter IV), there was little uniformity in the outcome measures utilized by programs to determine the effectiveness of an approach. This range in outcome measures impeded a statistically valid comparison across programs.

- HCOP Project Progress Reports and impact assessments infrequently presented data that was at the student-specific or even cohort level which would have allowed for accurate, individual analysis. Without primary data at this level, researchers had great difficulty in identifying the factors which led to the program's success and/or individualized student improvement.

All of these factors stem from the simple reality that few if any of the programs studied for this analysis implemented their approaches as if they were a "clinical trial". A detailed quantitative analysis, which includes a "control group" comparison, would involve a reassessment of the resources available to the projects, given their overall program goals and the complexity of the skills being developed.

The remaining sections of this chapter are going to address program approaches that were designed to meet the needs most consistently identified with minority/disadvantaged students and will provide:

- The **Evolution of Effective Learning Strategies**.

- Insights on the **"Deficit Learning"** approach, a key element in many supplementary educational programs.

- **Overview** of the approach frequently highlighted within the literature as one of the most promising in the development of cognitive skills. This approach, which evolved from the early theories of Piaget and Karplus, is generally acknowledged as a basis for the development of various **Collaborative Learning Strategies**.

- Sample applications of collaborative learning within **Conceptual Models**.

- **Major Findings and Conclusions** based on assessment of the educational literature, HCOP Progress Reports and the recommendations of the HCOP Work Group.

EVOLUTION OF EFFECTIVE LEARNING STRATEGIES

As discussed in the findings section of the Literature Search (Volume II of this report), research has shown that the underdevelopment of cognitive skills can lead to academic difficulty in advanced mathematics and science courses at all educational levels.[2] [3] [4] [5] The educational literature highlighted the fact that a significantly greater percentage of minority/disadvantaged students were educated in school systems which lacked the ability to effectively develop the cognitive skills necessary "for absorbing science concepts, for organizing them into a conceptual frame work, and for applying them in appropriate situations."[6] It is logical to deduce therefore, that educational approaches which target the improvement of cognitive skills may show a corresponding increase in academic performance. Based upon this theoretical premise, this chapter focuses on those approaches which are most likely to enhance the academic performance (academic-year math and science grades, and standardized test scores) and the retention rates of minority/disadvantaged students.

To provide an overview on the linkage between cognitive skills and academic performance, the following paragraphs highlight Jean Piaget's principles for skills development and Robert Karplus' use of these principles in developing a learning strategy to improve academic performance of students.

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[2] Association of American Medical Colleges (1992). Project 3000 by 2000. Technical Assistance Manual: Guidelines for Action.

[3] Epps, A.C., Cureton-Russell, M.T., and Kitzman, H.G. (1993, October). Effective Strategies and programs to Increase Minority Participation in the Health Professions for 21st Century. Journal of the Association for Academic Minority Physicians.

[4] Halpern, Diane et al. (1992). Enhancing Thinking Skills in the Sciences and Mathematics. Hillsdale, New Jersey: Lawrence Erlbaum Associates.

[5] Humphreys, Sheila M. (1980). Women and Minorities in Science: Strategies for Increasing Participation. Papers Presented at the Annual Meeting of the American Association for the Advancement of Science, January 1980, San Francisco, CA.

[6] McDermott, Lillian C., Piternick, Leonie K., and Rosenquist, Mark, L. (1980, January). Helping Minority Students Succeed in Science. Journal of College Science Teaching. 135-140.

According to the Swiss psychologist Jean Piaget, the higher order skills needed to solve complex science problems are thinking skills. Piaget describes highly developed thinking skills as formal thought or the level when an individual is "...able to reason abstractly -- to hypothesize and work from the abstract to the particular." This is consistent with views of today's educators who claim that, "...few minority students have the requisite higher order skills needed to [successfully] pursue professional degrees, particularly in the scientific and technical fields."[7]

Robert Karplus, Ph.D at the University of California at Berkeley was prominent in developing an educational strategy, the "Learning Cycle," noted for putting Piaget's theories to work in the college classroom. The "Learning Cycle" is based on "Piaget's idea that knowledge, to be useful for reasoning, must be constructed ... actively by the learner,"[8] and that teachers and peers play an important role in the process. The three phases of the cycle include:

- **Exploration** in which the students learn through their own actions and reactions by exploring new materials, ideas, and relationships with minimal guidance or expectation of accomplishment. Through questions and suggestions, the teacher can help students relate the new experience to their existing knowledge.

- **Concept Introduction** in which a new concept or principle requires the student to apply new reasoning patterns to their experiences. The concept may be introduced by the teacher and should always follow exploration and relate directly to exploration activities.

- **Concept Application** in which the students apply the new concept and/or reasoning pattern to additional examples. This phase is essential to extending the range of applicability of the concept and to help master the new reasoning pattern. -

Thus, the "Learning Cycle" provides for active participation by the learners during exploration and application, supplemented with instruction by the teacher during the concept introduction phase."[9] Group activities are used in conjunction with the "Learning Cycle" format to enable students to compare ideas, clarify misconceptions, and provide a supportive venue for multiple viewpoints and questions. Teachers have an opportunity to observe students throughout the cycle to evaluate the students' understanding and resolve pending difficulties during individualized student-teacher conferences.

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[7] Association of American Medical Colleges (1992). Project 3000 by 2000. Technical Assistance Manual: Guidelines for Action.

[8] Brodinsky, David and Irving Siegel. (1981). New Directions in Piagetian Theory and Practice. Lawrence Erlbaum Associates: Hillsdale, NJ.

Since the mid-1970s, a number of other educators developed programs that used the "Learning Cycle" strategies in the classroom. Some of the better known programs are:

- ADAPT (Accent on Developing Abstract Processes of Thought) implemented at the University of Nebraska,
- DOORS (Development of Operational Reading Skills) developed by Illinois Central College.
- STAR (Steps to Abstract Reasoning) created by Metropolitan State College in Denver.

All of these programs have shown statistically significant outcomes in terms of competitive course performance, high retention rates and timely graduation. It is important to note that none of these programs was designed specifically to meet the needs of minority/disadvantaged students.

In regards to the theoretical premise established at the beginning of this section, effective learning strategies which target improved grades and higher retention rates for minority/disadvantaged students may enhance the development of cognitive skills through:

- their willingness to participate in regulated, monitored practice of integrating information and concepts to solve complex math and science problems;
- the process of group interaction to affect a real improvement in critical thinking, problem solving and test-taking skills over time;
- the provision of frequent positive feed-back (verbal and written) to enhance confidence and self-esteem and the desire

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[9] Brodinsky, David and Irving Siegel. (1981). New Directions in Piagetian Theory and Practice. Lawrence Erlbaum Associates: Hillsdale, NJ.

to achieve competitive course grades and standardized test scores; and,

- the process of empowering students to employ critical thinking rather than making them dependent on tutoring. This may be particularly beneficial if one accepts the research that suggests tutoring relationships do not effectively promote transfer of needed academic skills.[10]

The literature review revealed that some approaches designed to address the needs of minority/disadvantaged students are inclined to be content-specific rather than providing interventions which link skills development to content areas. In many cases, this perspective has resulted in the use of deficit-focused, learning approaches.

DEFICIT LEARNING

As noted earlier, some developmental skills programs either explicitly or implicitly emphasize a deficit-focused delivery model. Their short term goal is in teaching students the specific skills that they have not yet mastered (i.e. note-taking, how to recognize the 'main idea' in a reading passage). For example, the reading teacher's goal becomes student improvement on a standardized reading test such as the Nelson-Denny Reading Test. Unfortunately, many students are able to gain skills sufficient to pass a skills development course but do so without developing the more intricate skills of advanced cognitive reasoning which will be critical to competitive academic performance in health professions schools.[11]

Additionally, the deficit learning model programs often carry with them the negative social perception that students participating in them are "lacking' in their ability to hold-their-own with the general population. As a result, students may develop a sense of embarrassment that hinders their ability to both benefit from the program and go on to be more successful in the general academic environment.

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[10] Martin, D. et al. (1982). "Supplemental Instruction: A model for increasing student performance and persistence," in L. Noel and R. Levitz (Eds.), How to succeed with academically underprepared students. Iowa City, IA: The ACT National center for the Advancement of Educational Practices.

[11] Stahl, N., Simpson, M., Hayes, C., (1992) Ten Recommendations from Research for Teaching High-Risk College Students. Journal of Developmental Education. Vol. 16, Number 1

The educational literature identifies a need for redirection of efforts embodied in the developmental skills approach into an approach which is more closely aligned with academic year curricula. The following two models provide an insight into how developmental programs could evolve into approaches more likely to enhance the higher levels of cognitive thought encompassed within deductive reasoning and problem solving. One of these approaches is identified as the "simulations model"[12] [13] in which texts and course materials from academic year courses provide the subject matter upon which the skills development course is taught. This allows students to practice new techniques using topic areas which are "real" or applicable to their own studies. The second approach involves more structured, supplemental instruction[14] which ties skills development to credit bearing, content-based courses. In practice this means that students desiring skills development receive the same course matter as traditional students, but it is delivered in a format more conducive to the development of the skill which is lacking. Students attending the expanded course format take exams on the same cycle as the traditional students but in reflection of additional time expended, students in the supplemental instruction course often get additional credit for the course. Both of the approaches outlined here relate to collaborative learning as detailed in the next section of this report.

OVERVIEW OF COLLABORATIVE LEARNING

The educational literature, HCOP progress reports, and observations recorded by the HCOP Work Group (HWG) strongly suggest that the collaborative learning strategy is the most promising learning approach to improve the cognitive skills and academic performance of minority/disadvantaged students. Its concept is embodied in the idea that students who study together, participate in group discussions and whose skills are developed in conjunction with the study of what is "real" to them (subject matter which is their area of academic concentration) are more likely to feel positive about themselves, their studies, and more likely to internalize what they have learned.

This strategy has its roots in the theories of Piaget and Karplus discussed previously.

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[12] King, J.R., Stahl, N.A. & Brozo, W.G. (1984), "Integrating study skills and orientation courses," Forum for Reading, 16. 6-13

[13] Nist, SL & Hynd, CR (1985). "The college reading lab: An old story with a new twist." Journal of Reading. 28, 305-309.

[14] Martin, DC (1980). "Learning centers in professional schools." in KV Lauridsen (Ed.), New directions for college learning assistance: Examining the scope of learning centers. San Francisco: Jossey-Bass.

Elements of collaborative learning effective for health professions success include:

- a type of group study frequently led by a facilitator;
- integration of cognitive skills development activities with math and science content domains;
- the nurturing of cognitive skills, in conjunction with academic year course work, over time.

Each of these elements multiplies the effects of the student's learning experience beyond the input of the initial program. Many studies have proven that interactive groups contribute a social element to the process which enhances the learning experience.[15] The need to integrate cognitive skills development with the subject matter has been elaborated by James Greeno and the Institute for Research on Learning. He explains that "the ability [for complex thought] grows through a progression of activities that increase in their difficulty, but they involve thinking from the beginning rather than having the opportunity to think withheld until the inventory of alleged materials for thinking has been stockpiled."[16] Within the context of higher level thought involving deduction and independent thinking, this quote elaborates on the continuous need to provide opportunities for the reinforcement of cognitive skills through out the student's process of developing scientific and health professions content knowledge.

In light of these considerations, educators recommend that academic enrichment programs designed to enhance the academic performance of minority/disadvantaged students should emphasize approaches that integrate thinking and learning skills together with course-specific content -- this is a basic element of collaborative learning that may be easily adapted to HCOP summer and academic year programs. As will be shown in Chapter V, there are several HCOP-funded programs utilizing elements of collaborative learning that have been clearly linked to positive student outcomes: competitive course grades, greater academic persistence and increased acceptance rates to health professions schools. Moreover, these outcomes are supported by valid and reliable statistical data.

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[15] Clark, MJ & Halpern, DF (1990). The million dollar question: Can an intensive learning experience improve success for the lowest quartile students?

[16] Greeno, JG (1992). "Mathematical and Scientific Thinking in Classrooms and Other Situations" Enhancing thinking skills in the sciences and mathematics.

CONCEPTUAL MODELS FOR COLLABORATIVE DEVELOPMENT

Collaborative learning models can, and do, vary greatly in terms of format, size of student groups and in how the learning sessions are conducted. Although variations of this approach are used at all points along the educational pipeline. The following are examples of some of the more commonly used models.

MODEL #1: Course-Linked Supplemental Instruction

This model begins with the identification of specifically targeted courses which serve as "gatekeepers" -- courses with which significant numbers of students encounter difficulty. Examples might include organic chemistry, physics or physical chemistry.

Support of the faculty and administration has proved to be essential to the long term survival of the program. The faculty member who instructs in this "historically difficult" course contributes materials and substantive support to a trained facilitator. This facilitator is likely to be a graduate student or an honor student in the discipline.

Student interaction centers on the application of learning strategies to content domains highlighted in lectures, seminars, or required readings. Snap shots of focused, critical areas of the course (as identified by the faculty member) are organized and presented in a manner which assists the student group to address the material critically, and to deduce both the essential content and the study methods which are best calculated to produce an end-of-term successful grade.

The overt curriculum in course-linked supplemental instruction is the content being covered in the text and lectures. The less evident curriculum addresses the most appropriate study methods to be used. Even less evident is the agenda which aims to help students to understand the ethos of higher education and to adapt their behavior (academic and social) to the model which prevails on the campus and in the discipline where they have elected to pursue their career goals.

Student participation in the supplemental learning program is typically voluntary, and usually no preselection process is employed to identify those most likely to benefit from this approach. When this method is used to target a specific student group, however, attendance requirements may be desirable.

The model seeks to integrate the academic content with skill development and social interaction around the nucleus of the content of the course. Group size can range from 2-25 students. Programs are usually connected to the academic year curriculum, although some advanced degree or specialized exam-prep programs may modify the approach to meet the requirements of the curriculum.

Currently, this model, or some variation of it, is used
by over 500 institutions throughout the United States and overseas.

MODEL #2: Small Group Interactive Learning

In this model, the learning approach is implemented in small groups (6-8 students) where participation is often voluntary but, on occasion, is mandated depending upon individual program goals. Within this context, the groups can be led by a trained facilitator. A diverse student mixture, in academic capability, gender and ethnicity, is desirable. Student profiles are assessed through the application of selection processes like those elaborated in Chapter III of this report. The assignments of students by faculty or staff to learning groups encourages an advantageous mixture of students, particularly when based on educational diversity. When group assignments are left to the student, the result is too often "birds of a feather grouping together" i.e. the stronger students selecting stronger students and leaving the weaker students, often intimidated by possible rejection, to group together by default. This approach is designed to be complementary and conducive to the interactive learning process. Study agendas are set either by the staff or the trained facilitator.

One adaptation of this model involves the addition of a video tape of a professor's lecture which focuses on the group's academic concentration. The video tape often includes a presentation of selected topic areas and relevant questions for discussion by the group. The benefit of the video is that it allows the group to learn at its own speed, i.e. - the group can stop, start and replay the tape, depending on the its need for reinforcement.

An increasing number of U.S. medical schools are utilizing video-based assisted learning to prepare students for the United States Medical Licensure Examination (USMLE). This collaborative learning approach is designed to fit within the 6 to 8 week, post-second year period that medical students are allotted to prepare for the USMLE. In 1993, twenty medical schools used the program, and 25 were scheduled to use it in 1994.

The small group interactive approach which utilizes targeted subject, video-taped lectures is particularly adaptable to the scheduling flexibility inherent in HCOP summer programs and reduced course load academic year programs. This approach is most effective when used either in conjunction with a currently attended course, or after the completion of the course as a review tool.

MODEL #3: Pair Problem-Solving

Perhaps the easiest and most cost-effective collaborative learning model is based on a "pair" group structure. A number of HCOP funded programs have used this approach which is advocated by Arthur Whimbey, Ph.D. who refers to it as the "pair problem solving" model.[17] This model calls for one student to be the problem-solver and a second student to be a listener. The listener's job is to ask probing questions and to listen to the thinking process of the problem solver. Pair problem solving not only assists students to better analyze and solve problems, but it also helps students to understand each other and brings them closer together. In addition, it helps students to better understand their own reasoning processes and those of their partners. This model can be readily applied within summer and academic year programs.

Group Dynamics

It should be noted that most forms of collaborative learning place emphasis on having a facilitator or group leader present. This is felt to be a necessary part of the process in order to keep the group on task with the content material and to guide the development of appropriate learning skills which the students can adopt and use. Other models place emphasis on forming study, cluster groups and then releasing them to perform in an unsupervised but collaborative study environment.[18]

MAJOR FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

The educational literature, the HCOP progress reports, and the deliberations of the HCOP Work Group collectively highlight the complex challenge of assessing the effectiveness of a given HCOP approach in improving the academic performance and cognitive skills of minority/disadvantaged students. This challenge is anchored in the fact that, taken as a group, HCOP programs employ a broad spectrum of educational approaches and learning approaches to address a common goal. This shared educational goal is to improve math and science content mastery of HCOP participants to a level that makes them competitive for health professions school entry and timely graduation.

The findings deemed most significant were those that were statistically related to the attainment of competitive academic year course grades and competitive standardized test scores. In those cases where validated data were provided, collaborative learning approaches played a key role in the program's success.

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[17] Whimbey, Arthur and Lochhead, Jack. (1984). Beyond Problem Solving and Comprehension. Lawrence Erlbaum Associates: Hillsdale, NJ.

[18] Johnson, D.W. et al (1991). "Cooperative Learning: Increasing College Faculty Instructional Productivity." ASHE-ERIC Higher Education Report. No.4. Washington, DC: The George Washington University, School of Education and Human Development

The 1994 Evaluation of HCOP Summer Programs[19] indicated that relatively few projects emphasized the use of the key elements of collaborative learning. For example, only 27 percent -- or less than 1/3 -- of the summer projects used a small group interactive learning approach in any aspect of their intervention programs; and, only 11 percent used small interactive groups as the primary learning approach.

Of the total number of HCOP Progress Reports reviewed for this research, only two listed collaborative learning strategies as a program priority:

- The first approach was integrated as part of a summer program that provided statistically significant data linking the achievement of higher than expected grades in math and science courses with participation in the program. For example, the outcome data of one of the HCOP Progress Reports supports the positive correlation between participation in the enrichment experience and a significant reduction in the attrition of minority students in two freshman courses -- pharmacy calculation and medicinal chemistry. Notably, this HCOP program used a collaborative learning approach based on Whimbey and Lockhead's textbook, "Problem Solving and Comprehension." The Whimbey approach has been field tested and is utilized by educators as an effective means of increasing students' ability to analyze problems, and better comprehend what they read and hear. The project integrated math and science content with problem solving exercises, and many of the students participated in these exercises over four consecutive summers.

- The second approach was implemented within the curriculum of a HCOP-funded post baccalaureate program. This project linked course content with a supplemental instruction session. The approach was designed to supplement difficult medical school courses. The data produced from this effort indicated that collaborative learning played a statistically significant role in assisting medical students who participated in HCOP-funded postbaccalaureate programs to achieve passing grades in several difficult basic science medical school courses.

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[19] Houston Associates, Inc. (1994). Evaluation of the Health Careers Opportunity Program (HCOP) Summer Programs.

The HCOP Progress Report review and HCOP Work Group (HWG) discussions surfaced several summer programs that incorporated the Whimbey Problem-Solving and Comprehension methodology in their respective curricula. These efforts however, unlike those of the project (highlighted above) that involved its students in collaborative exercises over several successive summers, were not directly linked to documented improvements in academic year grades or standardized test scores. These programs did report positive outcomes in terms of post-intervention test scores that were significantly higher than pre-intervention test scores. In addition, they reported that participants also demonstrated increased confidence in their problem-solving abilities.

The researchers additionally noted that several HCOP programs, that did not utilize the Whimbey or Supplemental Instruction approaches, also claimed positive outcome based on post-intervention test scores that were significantly higher than pre-intervention test scores. In contrast to the programs that linked skill development to content, however, this group of programs did not provide statistically significant data correlating their learning approach(s) to improved post program academic year grades or competitive standardized test scores.

The reinforcement of cognitive skills development over time is embodied in the learning strategies of Project 3000 by 2000 and HeadStart. This same philosophy was espoused by members of the HCOP Work Group (HWG). In concert with this view, individual HCOP projects should collaborate beyond the schools in which they are located. Ideally, it would be desirable to build regionalized, "vertical HCOP systems." These systems should support the continued reinforcement of cognitive skills as participants progress through post-secondary, undergraduate and graduate levels of education.

Conclusion

Collaborative learning is an important strategy because it provides or enhances key academic skills while empowering students to self-initiate critical thinking and to share their knowledge and insights with others in order to promote further learning. The small group interactive format associated with many collaborative learning approaches has been shown to be an effective motivating tool which is well received by students.

> *Students "who form study groups report that they both enjoy their work more, and feel they learn more, because of the academic discussions within these groups....In every comparison of how much students learn when they work in small groups versus when they work alone, small groups show the better outcomes."*[20]

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[20] Light, R.J. (1990). The Harvard assessment seminars: Explorations with students and faculty about teaching, learning and student life. Cambridge, MA: Harvard University.

The Division of Disadvantaged Assistance (DDA) should encourage HCOP applicants to incorporate collaborative learning approaches in their respective curricula. The research has shown statistically significant proof that collaborative learning approaches such as Supplemental Instruction (SI) and Video-Based Supplemental Instruction (VSI) can significantly improve the odds of students whose grade point average and/or standardized test scores place them in a relatively high-risk category for completing health professions curriculum. Grantees offering post baccalaureate instruction designed to prepare students for success in health professions schools will find SI and VSI helpful adjuncts to their curricula. As educators extend their reach into the high schools and junior high schools to create pathways that will fulfill the goals of the Association of American Medical Colleges'(AAMC) Project "3000 by 2000", they should introduce collaborative learning modes of instruction in their programs as early as possible. While the AAMC Project focuses on gaining future medical students, its concept has provided the foundation and motivation for programs in all areas of the health and science professions. The recommendations listed below, together with their corresponding guidelines (detailed in Chapter VI), will facilitate HCOP-wide goals and the implementation of effective educational interventions approaches.

RECOMMENDATIONS

The following recommendations have an excellent chance of being well received by HCOP grantee applicants because they place emphasis on approaches either currently being used by some HCOP grantees or methodologies originally developed with HCOP financial support.

#1 Encourage grantees to implement learning approaches that have been shown to be statistically effective in improving student comprehension and conceptual understanding of lectures and textbook material.

#2 Encourage all grantees to become familiar with collaborative learning approaches; and, to adopt those approaches which can best be supported by their existing resources and are most appropriate for the students targeted by their program.

#3 DDA should minimally earmark funds to support at least one Grantee in each region that has its objective the improvement of the science and math portions of standardized tests; and, makes a commitment to use collaborative learning approaches to improve basic arithmetic operations.

#4 Grantees should be encouraged to sponsor reading interventions that emphasize evaluation, application, and the incorporation of new information.

#5 Grantees should be encouraged to sponsor writing interventions that emphasize addressing the challenges that have been incorporated in the writing section of the MCAT (i.e. to define the given statement as thoroughly as possible, to explore the meaning of the given statement by giving a contradictory example and to discuss ways to resolve the conflict between the initial statement and the contradictory example).

#6 Grantees should be encouraged to implement activities in HCOP programs to cultivate non-cognitive skills, such as realistic self-appraisal and positive self concept.

#7 Establish a process by which HCOP program participants will leave the program with diagnostic results, specific information about the programs learning approaches, outcome performance and recommendations designed to enhance future development of cognitive skills.

CHAPTER III

SELECTION OF THE HCOP PARTICIPANT

Chapter III reports on the selection of participants for HCOP funded enrichment activities. As outlined in the introduction, this portion of the report meets the deliverable as directed under Task 6 of the project entitled "Research on Minority/Disadvantaged Support Programs." A specific objective of Task 6 is to "...develop and test criteria for identifying the characteristics of minority students with marginal academic credentials who are most likely to improve their competitiveness for acceptance into and retention in health professions training programs by participating in Federal support programs such as the Health Careers Opportunity Program (HCOP)".

The importance of defining the characteristics of the "marginal" or "at risk" HCOP student participant can best be appreciated in the context of the need of the Division of Disadvantaged Assistance (DDA) to more efficiently allocate scarce resources. Political, legal and financial forces are converging in a manner that has made the process for identifying "marginal" students and determining their level of 'relative risk,' critical. In today's fiscally conservative times, programs have little incentive to concentrate limited resources on minority/disadvantaged students who are unlikely, even with support services, to be accepted into and subsequently complete the course of study necessary to graduate from a health professions school.

This chapter is the result of an extensive literature search, the review of 44 specially selected HCOP Progress Reports (reflecting the activities of 10 individual projects), and the deliberations of a HCOP Work Group (HWG) comprised of experienced educators who have, or have had, HCOP grants. From these sources, several challenges were faced in the consideration of selection criteria for HCOP participants:

- The terminology commonly used to categorize prospective HCOP students, such as "at risk", "at academic risk" or "marginal" tend to be poorly defined. The definition of the "at risk" student in the HCOP Resource Book (September, 1994 HCOP Technical Workshop, Rockville, Md.) is an excellent example of this point. The HCOP Resource Book quotes "at risk" as: "low science GPA scores; low admission test scores; age and/or prolonged absence from academic pursuits; non-traditional majors; and, prior preparation at an institution with a less than substantial academic [curriculum]." Unfortunately, this definition does not translate into a mechanism useful in applying these variables in a way that takes into consideration the differences in the characteristics of these variables exhibited by applicants -- eg. the grade point average (variable) of a student may differ based upon the competitiveness of the school (characteristic).

- The process of categorizing minority students as "risk" or "marginal" often results in the misrepresentation that these categories define all minority students. It is safe to conclude, using any measure, that minority students are not all "marginal" or "at risk." Unfortunately, an unacceptable large number of minority students do have one or more of the "risk factors" described in the HCOP Resource Book. It is with the goal of serving the students in this latter group, that this report is addressed.

- The literature addressing the identification of "risk" or "marginal" student characteristics has largely involved only pre-medical and medical students. An objective of the contract is to identify characteristics/variables/indicators that could be broadly acceptable to HCOP grantees. The HWG recommended establishing a model that could be adapted to all health professions.

- The fact that Cognitive and Non-Cognitive Attributes are useful in measuring the level of "relative academic risk" related to a minority/disadvantaged student's acceptance into, and graduation in a timely manner from, a health professions school. The HWG pointed out that the Association of American Medical Colleges (AAMC) has already developed an extensive database on student cognitive and non-cognitive profiles representing medical schools. Data derived from various sources, including the AAMC's American Medical College Application Service (AMCAS) database and individual medical schools, are constantly analyzed and have led to volumes of medical education literature. This information is commonly assessed to identify the relationship between student undergraduate cognitive characteristics to academic performance in medical school. However, only a small portion of the literature published from the AAMC database has been devoted to factors that reflect how minority/disadvantaged students perform in medical school courses.

- The number of variables and their associated characteristics that could contribute to the "academic risk" status of a student are numerous. Therefore, it is not the best use of limited resources to focus principally on defining characteristics that would be "universally" accepted by HCOP grantees. However, it should be possible to identify a number of dominate variables to which each program would have the option of evaluating these variables in the context of a range of characteristics. The HWG members were confident that, in a relative sense, the same dominate variables that contribute to minority/disadvantaged medical students being at "academic risk" would also constitute risk factors in other health professions.

In the context of these issues, Chapter III will address:

- **Cognitive and Non-Cognitive Variables and Their Relationship to the Indicators of "Relative Academic Risk,"**
- **Developing Tools for Measuring Relative Risk Levels.**
- **Recommendations for the Selection of Students likely to benefit from participation in HCOP interventions**

COGNITIVE AND NON-COGNITIVE VARIABLES AND THEIR RELATIONSHIP TO THE INDICATORS OF 'RELATIVE ACADEMIC RISK'

The Role of Cognitive and Non-Cognitive Variables in Predicting Academic Performance:

The terms and definitions presented in the following sections of this analysis were derived from the literature together with HWG recommendations and the review of program reports.

The identification and enumeration of Cognitive and Non-Cognitive variables helps to define student attributes and skills into measurable data units which can be assigned weights, imputed into an algorithm and used to predict of academic performance. The research shows that when variables are given quantifiable values as a result of their input into an analysis tool, such as the Selection Index detailed later in this chapter, the result is a student profile indicating relative academic risk. The comparability of each variable is dependent on many factors. "Relative levels of academic risk" should be measured when risk is considered in the context of a student's potential for ultimate acceptance into, and completion of, the course of study necessary to graduate from a health professions school.

For the purpose of this analysis, characteristics, variables and their corresponding indicators will be grouped into one of two categories -- Cognitive and Non-Cognitive, the configurations of which are described as:

- **Cognitive Attributes** are those abilities and skills which are utilized to develop independent thought and to deduce answers for multi-facetted questions.
- **Non-Cognitive Attributes** are those abilities and skills which aid individuals to operate more effectively within society, such as, ability to concentrate and be

persistent in completing tasks, willingness to work hard, ability to identify clear and realistic goals and objectives.

Within this context:

- "Characteristics" are the qualities that distinguish a given variable -- eg institutional competitiveness can be used to distinguish grade point averages.
- "Variables" are the units for input into selection indexes in order to measure relative student risk levels,
- "Indicators" are defined as those 'flags' or 'markers' which evolve from the input of variables into a selection index, or other measures, and can be used by educators and program directors to identify which potential HCOP participants are most likely to succeed in the program.

Identifying Variables and Establishing a Basis for Their Relative Weights:

Program experience coupled with correlation analysis can produce "reasonable" weighting of variables. This initial process takes into account the unique value a program might assign to the characteristics of each variable. The subsequent validation of the importance of the variable and its associated characteristics can be accomplished through step-wise regression analysis.

One of the key challenges facing HCOP grantees is the vast number of possible characteristics, variables and resultant indicators, which could contribute to the measurement of "relative academic risk." Equally as important, what may be considered a basis for risk by one grantee may not be a risk for another. For example, commuting time may be a challenge for a HCOP program participant and/or health professions school student in a rural or suburban-area, but may not be as much of a risk factor for residents of urban areas with extensive public transportation systems.

Within this construct, the relative level of "risk" that a HCOP grantee applies to a student should be a function of a number of dominate factors. The relative value of each factor should be defined in relation to:

- program goals and objectives,
- the characteristics and needs of the target student population,
- curriculum design and available educational tools,

- staffing skills and knowledge base, and,
- program financial resources.

Even though the legislative objectives guiding HCOP projects are the same for each, individual projects are free to establish additional, personalized goals and objectives. As a result, objectives and activities vary greatly from project to project. As a result, objectives, the make-up of target student populations, curricula, quality and quantity of staff, and basic financial resources all have some influence on the academic performance of HCOP participants.

The matching of HCOP participants with the programs most likely to benefit them requires that HCOP grantees be able to predict how the each applicant's cognitive and non-cognitive attributes will interplay within the academic and non academic project environment. The research indicates that any assessment of variables is best accomplished on a project-specific basis, against measures/indices developed by each HCOP grantee.

The HWG members recommended that research in this area should begin with the literature which correlates medical school admission, retention and graduation with cognitive and non-cognitive variables. HWG felt very strongly that while this research utilized medical and pre-medical school student data, its results could be generalized to nearly all HCOP projects and other health professions. The results of these analyses show a statistically significant correlation between cognitive variables, such as college overall grade point average and the MCAT physical science and biological sub-test scores, with pre-clinical or basic science medical school course grades.

For example, one such study published by Friedman and Bakewell[21], focused on the relationship between MCAT sub-tests and the performance of 158 first-year University of North Carolina (class of 1978) medical students on the year-end comprehensive examination. They discovered that combinations of GPA and MCAT scores accounted for about 40% of achievement variance. These results were confirmed through several studies conducted at various universities throughout the United States. [22] [23] [24]

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[21] Friedman, Charles and Bakewell, William. "Incremental Validity of New MCAT". Journal of Medical Education. Vol 55, May, 1980.

[22] Cullen, Thomas and Dohner, Charles. "Predicting First Quarter Test Scores from the New Medical College Admission Test". Journal of Medical Education. Vol 55, May, 1980.

The studies demonstrate that it is possible to generally predict a student's relative risk of getting poor or 'marginal' grades in the first and second years of medical school basic science courses with some accuracy. However, few studies isolated minority-specific data which would have provided insights into any differentiation between the student populations. Additionally, the fact that a portion of the minority/disadvantaged students with modest overall GPAs and standardized test scores who are accepted into health professions schools do achieve competitive grades indicates that other factors, beyond their ability to score well on undergraduate academic tests and course work, play a role.

The need for this information led Sedlacek and others to search for other variables that might predict the academic performance of under represented minorities (URM) students. Their studies indicated that relative academic risk could be better estimated by considering non-cognitive attributes (as well as cognitive attributes) such as realistic self appraisal and positive self within the context of the pool of weighted variables. In this manner, non-cognitive attributes can better help identify which minority/disadvantaged students are likely to remain in school and graduate in a timely manner, than can be accomplished through the consideration of grade point average or standardized test scores (cognitive variables) alone.

Key Variables and Indicators for Predicting URM Academic Performance:

The literature shows that preclinical medical school academic performance by "majority students" can be predicted through the analysis of cognitive variables alone. This is generally true also in the case of students who rank in the 25 percentile of the nation.[25] However, research focusing on the spectrum of attributes exhibited by "marginal" minority/disadvantaged students begs further consideration of a broader range of variables.

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[23] McGuire, F.L. "The New MCAT and Medical Student Performance". Journal of Medical Education. Vol 55, 1980.

[24] Brooks, C. Michael and Jackson, James. "Validity of the New MCAT for Predicting GPA and NBME Part I Examination Performance". Journal of Medical Education. Vol 56, September, 1981.

[25] Anderson, J. and Mitchell, K. (1986). Pre-Admission Data and Medical Performance for Black Medical Students, from paper presented at AAMC Conference.

Sedlacek, Prieto and other educational researchers assert that cognitive variables alone (grade point average, standardized tests, course grades) are not as effective as predictors of academic success (achievement or persistence in a curriculum of study) for under represented minority (URM) students as they are for majority students.[26] Although Sedlacek has primarily studied non-health professions students, his research does point to the fact that non-cognitive attributes -- such as realistic self-appraisal and positive self-concept-- taken together with selective cognitive variables (such as GPA and SAT) can be used to help predict students' potentials for success in various academic curricula.

Sternberg[27] explains the difference between the predictive factors, as they relate to URM versus "majority students," by focusing on the student's societal experiences, and how these experiences influence patterns of learning. Sedlacek and Sternberg suggest that minority students develop and foster learning behaviors to deal with different societal challenges, such as cultural barriers, which majority students have not commonly experienced. It is these additional adaptive strategies which can contribute to a minority/disadvantaged student's ability to succeed both in the university environment and as a capable health professional.

Surprisingly to some, studies conducted at predominately minority universities such as Howard[28] and Xavier[29] conclude that GPA's and MCAT subtest scores are strong predictors of academic performance for minority students enrolled at their respective institutions. This conclusion is understandable in light of the fact that the students evaluated in these studies, and others like them, have largely homogeneous academic profiles (primarily composed of high GPAs and standardized test scores) which is in direct parallel to the circumstance within competitive majority schools.

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[26] Sedlacek, W. and Prieto, D. (1990). Predicting Minority Student Success in Medical School. Academic Medicine. 65(3) 161-66.

[27] Sternberg, R. (1986). "What Would Better Intelligence Tests Look Like?" In Measures in the College Admissions Process. New York: College Entrance Examination Board.

[28] Anderson, J. and Mitchell, K. (1986). Pre-Admission Data and Medical Performance for Black Medical Students, from paper presented at AAMC Conference.

[29] Carmichael, J.W. et al. (1988). An Assessment of a Pre-medical program in Terms of Its Ability to Serve Black Americans. Journal of the National Medical Association. Vol 80.

DEVELOPING TOOLS FOR MEASURING RELATIVE RISK LEVELS

Justification for the Development of Individualized Selection Indices:

Sedlacek and Webb[30] are currently involved in research which may lead to the listing of additional non-cognitive variables useful in predicting medical school performance. While the work of Sedlacek, Webb, Prieto, Sternberg and others provides a foundation for Selection Indices that incorporate non-cognitive variables, the assessment of cognitive skills alone has been proven to provide a 'jumping-off point' for further analysis. For example, Burke at the University of Illinois College of Medicine at Urbana-Champaign showed that 12 URM students who faced either dismissal or a repetition of the year (1983-1984), 11 were pre-identifiable on the basis of the Science GPA, Chemistry MCAT, and Physics MCAT, a 'true-positive' rate of about 92%. These findings were important for the University of Illinois College of Medicine at Urbana-Champaign. They pointed to a target group of "at academic risk" students who could have been identified and provided academic support services early in the academic process.

These findings, while insufficient to draw a complete picture of each student's relative risk have encouraged several health professions school to perform an in-depth analysis of the relationship of cognitive and non-cognitive variables with the academic performance of enrolled URM students. The application of an extensive step-wise regression analysis of dependent and independent variables is key to generating a selection index that defines relative academic risk. A selection index may enable admissions committees to limit their selection of students at high "academic risk" to those who have at least a 50% chance of graduating from the health professions school in a timely manner.

However, grantees should also be cautioned about the pitfalls of placing too much weight, and/or, collecting highly personal information which could be disproportionately weighted in comparison to its true value in predicting a student's academic performance. Institutions need to be careful when utilizing (and communicating the results of) non-cognitive variables whose measurements are highly subjective.

Appendix 4 identifies the variables and regression formulae that are currently used by a nationally recognized medical school to calculate the Selection Index for its College of Medicine. It should be noted that its Selection Index consists of both a Cognitive Index and a Non-Cognitive 'Diversity' Index.

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[30] Webb, Carmen M.D., Assistant Professor and Researcher for the Office of Medical Education, Medical College of Pennsylvania and Hahnemann University.

It is also important to point out that use of the selection index has:

- increased faculty confidence in the decision-making of the admissions committee; which in turn, buttressed faculty support for continued minority student admissions; and,
- enabled the admissions committee to select URM students with modest academic profiles who were at moderate-to-low risk of not completing their medical education.

It is likely that all institutions of higher education use some type of "indexing" in the selection of their respective students. However, the majority of institutions do not have "rigid" indices based on statistically valid formulae. It is often the case that admission committees of these institutions make acceptance and rejection decisions, particularly those involving URM students, on the basis of "generally understood cognitive and non-cognitive cut-off variables." For example, it is frequently the case that admissions committees reject any student with a MCAT sub-test score of 4 or less, and/or any student who had a GPA of less than 2.30.

Dependence upon Standardized Tests, such as the MCAT, as a Principle Basis for Selection:

The suspicion of grade inflation and unfamiliarity with historically Black colleges or smaller/less known undergraduate schools, encourages health professions school admission committee members to view national standardized test scores as one of the "fairest" parameters in the selection of URM students. Unfortunately, this line of reasoning too often provides admission officers and admission committees an "easy out" in the selection process. In fact, logic indicates that there is a certain moral comfort in placing the difficult decision of acceptance or rejection on the shoulders of an "objective test" such as the MCAT.

This point was underscored during the HCOP Work Group (HWG) sessions. One of the members summarized an unpublished study which indicated that one hundred and fourteen (114) medical school admission officers ranked their selection variables (once initial screening has been completed) in the following order of importance:

- medical school interviews and reference letters, are weighted highest, followed by -
- undergraduate, post-baccalaureate and/or graduate cumulative or science GPA average
- MCAT score

Most of the HWG members did not find the ranking priorities surprising, given the fact that the majority of enrolled medical students have relatively similar, high grade point averages and high MCAT scores. Nearly all students who are finally considered for acceptance by a medical school admissions committees have science and overall grade point averages that fall with in the 3.5 to 4.0 range. That same group of students have MCAT sub-test scores that fall in the range of 9-15 and total MCAT scores that fall in the range 27-42.[31] Therefore, the interviews and reference letters are the mostly likely points of differentiation during the selection process. The homogeneity among majority students is related to the fact that students with lower scores and GPA's are not willing to spend significant resources on applications which are highly unlikely to be successful.

While the study results did not surprise any of the HWG members, they were unanimous in their concern about how the results tend to be used and interpreted by the public. It is their belief that contrary to the final selection process outlined above, medical schools initially focus on the selection variables which are applied to URM student applications in the following order:

- MCAT scores
- undergraduate, post-baccalaureate and/or graduate GPA averages
- medical school interviews and letters of reference

A probable explanation for this behavior stems from the fact that URM medical student profiles, with regards to their grade point averages and MCAT scores, are much more diverse than those of majority medical students. A large percentage of minority students who are finally considered for acceptance by a majority medical school admissions committees have a science and overall grade point average that falls in the range of 2.3 to 3.5. That same group of students have MCAT sub-test scores that fall in the range of 5-8 and total MCAT scores that fall in the range 16-26. It should be pointed out that minority students in this "acceptable pool," often have high grade point averages ($\geq$ 3.4), but low MCAT scores; or often have high MCAT scores ($\geq$ 8) and low grade point averages ($\leq$ 2.5). Relatively few have both, high grade point averages and high MCAT sub-test scores.

The HCOP Work Group (HWG) was unanimous in its belief that including variables such as an applicant's participation in a HCOP or HCOP-type program into the admissions process could reduce concern about a student's relative risk level based on MCAT scores alone.

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[31] 1994 Association of American Medical Colleges' MCAT Reporting Series.

Finally, at the same time that HCOP grantees work to change the criteria by which URM students are selected, it is necessary to help the present URM students to meet the selection requirements of health professions admissions committees. This means improved MCAT scores, improved GPA, and improved interviews as addressed in Chapter II of this report.

Justification for Consideration of Other Variables:

Published correlation studies report that the Physical Science MCAT sub-test score can explain 30 to 40 percent of the variance in medical school basic science course grades. Grade point averages also evidence a higher correlation to medical school basic science course performance. However, these statistical correlations primarily depict the academic performance of "majority medical students."[32]

One key variable which would help predict the performance of URM students -- previous HCOP participation -- rarely is reported. Nearly all statistical correlation models, focusing on URM academic performance, include relatively little or incomplete information on the student's previous participation in one or more HCOP or HCOP-like program(s). The studies that have correlated participation in an HCOP program with health science school performance:

- do not include indications about whether any effort had been made to see if the student had participated in more than one HCOP or HCOP-like experience;
- do not provide data assessing the relative impact of the HCOP experience on the participant's course performance in comparison to cognitive and other non-cognitive variables.

The success of HCOP postbaccalaureate programs (see appendix 6) strongly suggests that participation in a HCOP or HCOP-like academic enrichment experience has reduced the relative risk of selective URM students. There is evidence that the reduction in risk has been accomplished with only a modest improvement in the participant's MCAT subtest scores. As illustrated in Appendix 4, there is a need to utilize step-wise regression formulae to statistically predict if previous HCOP or HCOP-like post baccalaureate program participation will reduce the relative risk of URM students with marginal academic profiles.

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[32] Association of American Medical Colleges. (1994) MCAT Validity Studies. Washington, DC

FINDINGS AND RECOMMENDATIONS FOR THE SELECTION OF STUDENTS LIKELY TO BENEFIT FROM PARTICIPATION IN HCOP INTERVENTIONS.

Findings on Participant Selection Process:

The literature is filled with studies which show that undergraduate cumulative grade point averages (UCGPA) and undergraduate cumulative science GPAs (UCSGPA), together with physical and biological science MCAT sub-test scores, have statistically significant correlations to successful performance in medical school basic science courses.

Within the context of minority/disadvantaged students, the HCOP Progress Reports, as well as, the comments expressed by the HCOP Work Group (HWG) participants, support the philosophy that non-cognitive attributes should be an important part of the academic risk assessment. A number of HCOP programs have collected non-cognitive data utilizing a validated diagnostic test; but, only a few have analyzed the non-cognitive data to predict levels of academic risk.

The key to the selection of minority/disadvantaged students who are more likely to benefit from HCOP interventions, is the application of both cognitive and non-cognitive criteria within a structured and controlled selection index process. This will yield greater insights into the capabilities of individual applicants and a comprehensive profile of the indicators which are most useful in determining a student's level of academic risk.

The findings outlined in this report describe the role of many cognitive and noncognitive variables which should be considered when assessing a student's academic risk. Unfortunately, terms such as "academic risk" and "marginal" student are not clearly defined. Variations between programs show different meanings from one HCOP/health professions admissions committee to another. This report underscores the fact that "relative risk" and "marginality" tend to be defined primarily by cognitive variables within the context of institutional or program biases.[33]

The magnitude and variety of the factors that come to bear on the prediction of "academic risk" suggests it would be fruitless to try to develop a common definition of "academic risk" that would be "universally" acceptable to HCOP programs and/or to health professions schools. Therefore, this report proposes that each HCOP program attempt to quantify levels of student risk based on the following indicators:

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[33] Highlights of On-Site Interview Findings, Evaluation of the Levels of Academic Risk Associated with Applicants to HCOP supported Health Professions Schools, March 22, 1991, prepared under contract #240-90-0034, submitted by Levine Associates, Inc.

- the academic and non-academic profiles of the student applicants; and,
- the program performance objectives; and,
- the financial and non-financial resources available to support the HCOP program.

The following recommendations reflect these findings and the need for greater information to support the process of HCOP participant selection. Each of the targeted recommendations included below is designed to enhance the capacities of minority/disadvantaged students to gain competitive acceptance into and timely graduation from the health professions schools.

Recommendations

#1 Encourage HCOP Grantees to utilize both cognitive and non-cognitive variables as a basis for the selection of HCOP participants and the matching of those participants to the programs which are most likely to benefit them.

#2 Grantees should be encouraged to collect the "minimum data set" (discussed in Chapter IV) together with additional information from student applications, letters of recommendation, by telephone or personal interview and when possible by means of pre-admission cognitive and non-cognitive assessment tests.

#3 While Grantees should be encouraged to use non-cognitive variables in conjunction with cognitive variables, they should be strongly cautioned on how best to apply this information within the emotionally charged context of the student selection process.

CHAPTER IV

ASSESSMENT OF HCOP PROJECT DATA

If *Chapters II* (Interventions) and *III* (Participant Selection) can be thought of as a description of the 'vehicle' which drives HCOP projects, then *Chapter IV* endeavors to provide the 'fuel' which powers this vehicle. The literature, together with a detailed analysis of program progress reports and recommendations from the HCOP Work Group (HWG), supports the premise that the 'fuel' upon which quality, cost-effective and well monitored programs must run, is **DATA**.

This chapter addresses the identification, collection, analysis and application of key data elements or 'variables' as they relate to the design of individual HCOP interventions, the selection of HCOP participants, the subsequent monitoring of program components and the assessment of program impact, particularly over time. As outlined in the Introduction section of this report, Chapter IV relates directly to the deliverables as defined under Tasks 6, 10 and 11 of the project entitled "Research on Minority/Disadvantaged Support Programs." These tasks encompass the development and application of a methodology for assessing HCOP Project Reports and program outcomes. In conjunction with Task #6, this report will provide insights into linkages between various selection criteria and HCOP participant progress.

As a foundation for the recommendations included at the conclusion of this chapter, the following components will be presented within this section of the report:

- Synopsis of Current Data Collection Activities as Directed by the Division of Disadvantaged Assistance,
- The Effective Organization of Data, and,
- Findings from the Review of Data Encompassed in HCOP Grantee Progress Reports,
- Issues and Barriers faced by HCOP Projects in Collecting Useful Data,
- The Importance of Collecting Comparable Data (across programs),
- Recommendations for Future Data Collections Efforts.

SYNOPSIS OF CURRENT DATA COLLECTION ACTIVITIES AS OUTLINED BY THE DIVISION OF DISADVANTAGED ASSISTANCE

Historically, the data collection activities carried out by HCOP grantees have emphasized the racial/ethnic and financial profile of the student population, the number of minority/disadvantaged students entering health professions school, and the retention and graduation of minority/disadvantaged students from health professions schools. The structure of these activities is grounded upon the purposes established in the HCOP legislation (recruitment, preliminary education, facilitating minority/disadvantaged student entry and retention within health professions schools). The data variables requested are identified in the HCOP grant application and include the following:

- First Year Enrollment of Disadvantaged Students by Race/Ethnicity and Year

- Total School Enrollment by Race/Ethnicity and Year

- Academic Progression: Graduating Class of Disadvantaged Students by Race/Ethnicity and Year

- The Number of Disadvantaged Students Enrolled in Health Professions Schools and Allied Health Programs -- listed by Academic Year

- HCOP Competitive Application Grids are organized into three data collection groupings:

  Total Trainees
    - from metropolitan areas
    - from non-metropolitan areas
    - from areas unknown
    - above low-income level
    - below low-income level
    - income level unknown

  Recruitment Activity Beneficiaries
    - total individuals provided health careers information
    - total individuals provided health careers counseling
    - total individuals provided health careers lectures

  Current and Previous Program Participants Tracked During Reporting Period

Grantees provide HCOP with the data outlined above, to the best of their ability, in an "aggregate" format, utilizing the grids provided in the HCOP Application Guidance. In addition, supplemental data are collected on a program-specific basis in response to individual needs.

THE EFFECTIVE ORGANIZATION OF DATA

This research has shown that the collection of student-specific, cohort and aggregate data which is reliable and valid provides a useful foundation for the design, implementation and assessment of HCOP efforts. The HWG shared this view and expressed great enthusiasm about the prospect of participating in the development of guidelines through which appropriate data could be collected and analyzed. They also expressed a perspective that is consistent with the literature review -- that the cornerstone of the data collection process is **Student-Specific Data**. From this initial stage of collection, data can be organized and analyzed in Cohorts and in the Aggregate. While it is possible to build up to aggregate data from individual student academic records, it is only rarely possible to accomplish the reverse. Within this context data collection and assessment can be seen as stages in an evolutionary process,

*moving from →**Student-Specific** to → **Cohort** and leading to → **Aggregate***

In understanding the applicability of project data to future programming efforts, these data 'stages' might be viewed as part of a continuum of analysis leading to the development of viable and effective recommendations. The foundation of this process is in the collection of comparable data elements which can be used to statistically validate relationships between interventions and outcomes. Therefore, the stages can be conceptualized as follows:

Student-specific data provides the greatest insights about the relationships between cognitive/non-cognitive variables and academic performance. These insights are critical for the development of reliable participant selection criteria. This data is also valuable for the initial stages of intervention design and to determine program impact on project participants. Caution, however, must be taken to ensure that student-specific data is kept confidential. For example, a minimal level of confidentiality may be achieved through the deletion of names and social security numbers from files and replacing this information with, for example, HCOP identification codes.

Cohort data presents information in groupings by like variables which are useful in drawing correlations between program participant skill levels and the application requirements of various health professions schools. Additionally, cohort data, consistently captured in "like data elements", lends itself to constructive comparative and impact analysis over the life span of individual HCOP-funded efforts. This level of analysis is very useful in determining the transferability of a given intervention strategy.

Aggregate data offers summaries of important program elements and participant profiles useful in communicating information on a broad spectrum of HCOP-supported strategies. In addition, it is frequently used to provide comparable assessments of programmatic impacts. However, this level of data rarely demonstrates a clear cause-and-effect relationship between program interventions and individual student performance .

Grantees are frequently called upon to develop 'snap shot' analyses which provide a generalized picture of program activity. Aggregate and Cohort data are particularly useful for fulfilling this purpose. For example, prior to an upcoming university promotions committee meeting, the Dean of a school might request that the HCOP project director provide a quick performance review of current HCOP participants. Because student progress may vary greatly from survey point to point, caution should be taken with respect to the predictive reliability of these 'snap shot' analyses.

In comparison, student-specific data or even cohort data, which is tracked over several program periods and preferably between project cycles (eg; each year or semester), includes information which is verified, is more likely to provide a better understanding of the risk factors associated with minority/disadvantaged HCOP participants and the relative impact of the HCOP intervention employed.

FINDINGS FROM THE REVIEW OF DATA ENCOMPASSED IN HCOP GRANTEE PROGRESS REPORTS

HCOP grantees collect data that varies greatly in terms of the amount, type, quality and utility. Grantees use a wide variety of reporting formats to describe their participants and to support claims pertaining to program effectiveness and general outcomes. An extensive review of HCOP Grantee Progress Reports and observations from the HCOP Work Group (HWG) indicates that HCOP grantees have attempted to collect and report project data in a manner that reflected HCOP's legislative intent -- to increase in the aggregate, the number of minority/disadvantaged students entering and graduating from health professions schools. Moreover, the HWG expressed the opinion that Grantees' abilities to collect, assess and present detailed data analyses were limited by the amount of dollar resources each program could allocate to the data assessment process, staff knowledge of quantitative analysis techniques, as well as, the program's access to HCOP participants' post-program academic records.

The following subsections describe the levels of data historically collected and assessed by HCOP Grantees, as reflected in their progress reports and HWG discussion. This information is presented in an order which ranges from the most frequently reported level of data to the less frequently reported level:

Aggregate Data

In appears that the majority of HCOP grantees have historically presented data in the aggregate. This data has been generally useful. For example, its value is reflected in illustrating the correlation between HCOP-funded programs and the dramatic increase (between 1970-1975), and subsequent plateauing, of large numbers of underrepresented minority (URM) matriculating and graduating health professions students. It has also enabled the Division of Disadvantaged Assistance to track and assess the impact of appropriated dollars. The outcome information generated by this aggregate data shows a general relationship between ethnicity, income, group grades, group standardized test scores and total numbers of students. The documentation responds to the intent of the Health Manpower Act (the authorizing legislation for HCOP is Section 740 of the Act, as amended by the Health Education Extension Amendments of 1992) which requires that HCOP dollars be used to increase the number of disadvantaged students entering and graduating from health professions schools (see Appendix 5).

The aggregate data format is also useful for framing an hypothesis and reinforcing intuitive conclusions. For example, Charles F. Whitten M.D., Associate Dean of Curricular Affairs, Wayne State University School of Medicine, maintains that the AAMC's projected goal of 3000 by 2000 (increase to 3000 by the year 2000, the number of URM matriculants into health professions schools) is not likely to be achieved. He maintains that the goal can better approximated if more post baccalaureate programs are funded and implemented. Whitten has effectively used aggregate data to illustrate that there has been neither an increase in the applicant pool of URM students between 1981 and 1990, nor an improvement in the applicant pool's quality, as depicted by ethnic group GPA and MCAT mean scores (see Appendix 2). These students -- those who are now or will be eligible for application to medical schools by the year 2000 -- are already fairly far along the educational development pipeline.

Appendix 6 illustrates how the use of aggregate data by past and present HCOP-funded post-baccalaureate programs can be used to portray the strong association between participation in their programs and the participant's subsequent entry into, and graduation from, a health professions school (see Appendix 6). This data supports the recommendation for more post-baccalaureate programs which can strengthen the competitiveness of the existing applicant pool.

Notably, the aggregate data format is not as effective a mechanism to depict the correlation between HCOP-funded interventions and individual student performance. Additionally, it does not shed additional light on the specific academic profiles of the students who gained acceptance and the students that were rejected by medical schools. Aggregate data lacks the level of detail needed in order to design and implement the most appropriate intervention which can help mitigate the gap between the minority and majority matriculant pools. For example, little of the following insights can be deduced:

- How many of the accepted students had cumulative science grade point averages of
$\geq$ 3.00, and/or a MCAT physical science subtest
score $\leq$ 6?

- Which of the accepted students with cumulative science grade point averages $\leq$ 3.00 and/or total MCAT score $\leq$ 22 attended a Historically Black College or University?

- Which of the accepted students participated in an HCOP academic enrichment program?

Even though quality aggregate data is constructed from student-specific data sources, there may not be, as has been the case for many HCOP funded projects, sufficient incentives for HCOP projects to focus on analytical efforts on student-specific data.

Cohort Data

Several HCOP funded programs have been able to generate generally enlightening information about their respective applicant and participant pools by using cohort data. From the research, "cohort studies are the design of choice for studying the course of ... risk factors, because they can be readily designed to be longitudinal and follow a group of subjects over a period of time."[34]

Grantees should be able to analyze this level of data at a relatively small dollar cost. The Progress Report review revealed that some grantees have utilized this format as the next level of analysis, after presentation of aggregate data, to draw correlations between selective variables, or a group of variables, and outcomes.

For example, the data highlighted in Appendix 7 strongly indicates that if variables such as GPA and MCAT scores are similar for two subgroups (cohorts), the grantee may explore other variables that may correlate to academic performance. The 'dependent' variable which differentiates the two cohorts in this Appendix is '**previous participation in a HCOP academic enrichment program**' -- which may explain why Cohort A performed better in medical course work than Cohort B.

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[34] Dawson-Saunders, Beth and Robert Trapp. (1994). Basic and Clinical Biostatistics. Appleton & Lange: Norwalk Connecticut.

Over the years grantees have utilized cohort data to provide DDA with greater insights into which variables are most likely to affect program outcomes. To understand the degree (or the level of weight each variable should be given) to which a variable will impact each outcome, some grantees have collected and analyzed more student-specific data as indicated in Appendix 8. From the progress reports it appears that when a multiplicity of variables correlate to the assessment goal -- which is often the case with student-specific data -- multi-variate and regression analyses is invaluable in gauging their relative importance.

Student-Specific Data

As mentioned previously, aggregate data plays a significant role in highlighting general trends in program outcomes, developing general student profiles and in the presentation of information supporting the need for the continuation of Federal supplementary education programs, such as HCOP. Cohort data differentiates and helps categorize information into relatively small representative data sets which are useful in reporting more specific program outcomes than would be possible with aggregate data.

However, it is through the collection, assessment and utilization of student-specific data that verifiable trends and outcomes can be measured effectively. The information gained from this level of data is valuable, not only in accessing program impact but, in the planning and development of the HCOP-funded interventions. Student-specific data provides opportunities for continued fine tuning throughout the HCOP intervention rather than only between new program cycles.

Some grantees have used student-specific data to customize skills development strategies in light of individualized student needs, to establish program specific selection criteria and to link intervention approaches (and components of these approaches) to student participation in the HCOP projects. Appendix 8 illustrates how one grantee applied regression analysis to determine the relative weight of the contribution made by a student's level of cognitive skills to his or her performance in first and second year medical school courses. Appendix 9 examples the use of student-specific data in the customization of counseling efforts within an appropriate intervention.

Issues and Barriers Faced by HCOP Projects in Collecting Useful Data:

HCOP grantees have generally done a good job in collecting and communicating the "aggregate" data solicited within the grant application grids. However, this level of data does not allow for an effective assessment of the benefits gained by individuals from various HCOP supported strategies. Moreover, the "aggregate" nature of the data reported makes tracking of HCOP participants beyond their immediate participation and subsequently, throughout the health professions education system, very difficult.

The review of progress reports completed for this analysis found that the majority of grantees collect a wide variety of student-specific data. This information is often derived from student completed applications. However, the spectrum of characteristics tracked and variables measured differs greatly from one HCOP grantee to another. Therefore, comparisons across programs and over time are extremely difficult to analyze. Additionally, when student-specific information has been reported, the research has shown that it is often not well defined. For example, grantees frequently do not indicate whether GPA listing represents a cumulative science GPA or an overall GPA. Very often, in the case of reported standardized test scores (eg MCAT) and GPAs, no notation is included indicating whether the information came from official or unofficial transcripts, and, whether the scores/GPAs had been validated or student self-reported.

HCOP Work Group (HWG) members were of the opinion that the most significant barrier to the compilation and subsequent analysis of student-specific and cohort data is related to resource limitations. One of the critical factors lacking in many HCOP projects is a sufficient number of staff -- especially staff trained in the development of project evaluation methodology and quantitative data analysis -- to design and implement assessments. Overlaid on these limitations are the demands of day-to-day program implementation, complicated confidentiality issues, inappropriate computer hardware and software, and institutional bureaucracies which limit the access of program managers to key information sources.

These findings, together with more extensive discussions during the HWG meeting, led to the recommendations that; a) a data collection template be centrally developed and provided to each Grantee, and, b) that a data clearinghouse be established to provide a conduit for the exchange of information and technical assistance.

The Importance of Collecting Comparable Data (across programs):

It is increasingly important to demonstrate a clear cause-and-effect relationship between HCOP-funded programs and the ability of minority/disadvantaged students to perform well in science courses and on standardized exams such as the Medical College Admissions Test and the United States Medical Licensure Examination. Unfortunately, such relationships are not clearly evident from the available data. The apparent emphasis on resource allocation in support of program interventions over quantitative analysis, may be a contributing factor to the limited ability of programs to collect statistically validated data. Moreover, it would be difficult to compare data across programs because programs frequently collect dissimilar data elements.

The progress reports and HWG deliberations indicate that for comparisons to be developed which measure results 'across' HCOP projects, project grantees must be willing to participate in the establishment of a "minimum data set." Additionally, for the data collection to be successful, each Grantee must be willing to integrate these data elements within each project's tracking effort. A "minimum data set" such as the one proposed under Chapter IV's recommendations will facilitate:

- the design of interventions based upon accurate representations of target population and grantee/program characteristics;
- the translation of these characteristics into variables for input into selection indices which result in the identification of key indicators of projected student performance;
- the monitoring and assessment of program proficiency and cost-effectiveness; and,
- the drawing of statistically validated correlations between HCOP interventions and increases in the number of minority/disadvantaged students who are accepted into health professions schools and graduate in a timely manner.

Thus, the "minimum data set" and the effective analysis of the data generated will provide insight into which interventions may be worth replicating in other locations. Additionally, the information gained from this level of data will translate into a more accurate representation of the aggregate impact of HCOP efforts on a national basis.

However, the collection and utilization of this data carries with it two key considerations:

- **Safeguards** must be established to protect confidential information provided by students. For example, a student identifier, such as a social security number, can be used to link student data elements.
- The **Collection** of **Reliable** and **Validated data** presents a significant challenge for grantees whose staff time and quantitative analysis capabilities vary from program to program.

In addition, to maintain consistency among discussants around the issues related to data quality and the security of privileged information the collection effort must ensure that the following criteria are met:

- **Safeguards** - moral and legal considerations demand that in the compilation and use of any data, especially student-specific data, shields are needed to ensure confidentiality.
- **Reliability** - relates to the consistency of statistical outcomes measured under identical conditions. For example: MCAT scores are considered reliable because the exam is administered under standardized/identical conditions, and the reported scores after each test administration are consistent with established norms.
- **Validity** - the extent to which data utilized in analysis and reporting presents an accurate representation of program outcomes and student characteristics. Validity also applies to an instrument of measurement in that it measures what it purports to measure.

Additionally, a common interpretation of these criteria is critical for ensuring a 'level playing-field' among the HCOP projects for the purpose of data collection and analysis. This commonality of thought, together with the understanding and resources needed to effectively collect and process the most appropriate level of data for a given task, are critical for the continued evolution of HCOP efforts. The following recommendations reflect the research, program evaluation and HCOP Work Group (HWG) findings which point to the key areas of supplement needed.

RECOMMENDATIONS FOR FUTURE DATA COLLECTION EFFORTS

The following recommendations are based upon the research findings and analysis:

#1 Develop a "universal minimum data set" for high school, college and health science school programs respectively, and, encourage all funded programs to incorporate this "data set" within their respective applications. Encourage Grantees to exchange the results of their data collections, perhaps through the utilization of a national data clearinghouse.

#2 Develop and provide all HCOP grantees with a Common Data Template (as presented in Chapter III) on a 3.5/5.25 floppy disk and encourage all programs to utilize it. This template will serve as a guide for the collection, maintenance and communication of minimum data requirements.

#3 Encourage grantees to collect both the cognitive and non-cognitive data needed to calculate their respective selection indices; and analyze that data for performance outcomes.

#4 To the best of individual capabilities, encourage HCOP grantees to track participant beyond participation in program and when possible, throughout the student's health professions education.

CHAPTER V

A SAMPLING OF INTERVENTIONS DESIGNED TO IMPROVE THE COMPETITIVENESS OF MINORITY/DISADVANTAGED STUDENTS

Several sources concur that HCOP funded programs have indeed been successful in directly, or indirectly, assisting thousands of minority/disadvantaged students to enter, and graduate from, health professions schools.[35] [36] However, researchers' ability to independently assess specific HCOP approaches, let alone to draw comparative conclusions, is hindered by the limited availability of statistically validated data necessary for quantitative evaluation. Unfortunately, as explained in Chapter II, relatively few HCOP programs have published student-specific or cohort specific information that links participants' academic year grades and standardized test scores (post HCOP) with the learning approaches they received through HCOP.

Chapter V contains descriptive summaries of six programs. Each of these programs has (in somewhat varying degrees and formats) produced statistically significant data which strongly suggests correlations between its interventions and students' post-program academic performance. Published findings and program data document the fact that a high percentage of participants (students with modest to poor grades and standardized test scores) of selective academic enrichment programs have gone on to:

- receive passing grades in highly competitive science and math courses;[37] [38]

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[35] Thomas, S. (1994). "After Two Decades, HCOP Continues to Create Opportunities in Health," Black Issues in Higher Education. 18-19.

[36] Testoff, A. and Aronoff R. "The Health Careers Opportunity Program: One Influence on Increasing the Number of Minority Students in Schools of Health Professions." Public Health Reports, Vol. 98, No. 3. May-June, 1983.

[37] Bridgham, Robert and Stacia Scarborough. "Effects of Supplemental Instruction in Selected Medical School Science Courses". Academic Medicine. 67(10), pp 569-571.

[38] Fullilove, Robert E. and Treisman, Philip U. (1990). Mathematics Achievement Among African American Undergraduates at the University of California, Berkeley: An Evaluation of the Mathematics Workshop Program. Journal of Negro Education. 59(3) pp 463-478.

- achieve passing scores on standardized tests;[39] [40] and,
- graduate from health professions schools on schedule.[41] [42]

METHODOLOGY FOR SELECTION OF PROGRAM SUMMARIES

There is relatively little information in the educational literature which provides statistical validation that the specific learning approaches used by HCOP funded programs have been effective in improving specific cognitive skills. However, there is statistically significant information that clearly shows the truly important correlation between participation in selective academic enrichment programs, inclusive of some funded by HCOP, and improvements in academic year science course grades and standardized test scores.

The methodology used to select the programs summarized in this chapter emanated from a thorough review of the educational literature, HCOP Grantee Progress Reports and recommendations

proposed by the HCOP Work Group (HWG).

During the first stage of this analysis, each program was screened for information pertaining to intervention methodologies, and instruments used to measure improvements in grades and/or standardized test scores that could be ascribed to the program as a whole or to a specific sub-intervention.

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[39] Blanc, R. and Martin, D. (1984). "An Evaluation of a Preparation Program for Medical Students Who Previously Failed Part I of the NBME Examination". Journal of Medical Education. Volume 59, pp 667-669.

[40] Frierson, H.T. (1984). "Impact of an Intervention Program on Minority Medical Students' National Board Part I Performance". Journal of National Medical Association. Volume 76, pp 1185-1190.

[41] Review of Research Concerning the Effectiveness of SI from the University of Missouri-Kansas City and Other Institutions from Across the United States. (1994). National Center for Supplemental Instruction, UMKC. Kansas City, MO.

[42] Unpublished Data, Georgetown University School of Medicine. Washington, DC.

Secondly, programs containing the elements outlined in the first stage were meticulously screened for student specific and/or cohort data that would indicate the intervention methods they employed were effective in improving regular course grades or standardized test scores of minority students at 'academic risk.'

Thirdly, the data and conclusions were analyzed to determine their reliability and validity.

This process resulted in the identification of a group of key characteristics that could be used to identify those programs exhibiting statistically significant improvements in participant academic year science and math course grades and/or standardized test scores. Based upon the premiss established in Chapter II, statistically significant increases in course grades and/or standardized test scores provide indirect evidence of strengthened cognitive skills.

The following characteristics provide a framework for selection of the programs summarized in this Chapter:

- A target group consisting of at least 50% under-represented minority (URM) or minority/disadvantaged students; and,
- An indication that the intervention could be readily adapted for use by HCOP Grantees.
- The evidence of program impact was derived from control group comparative evaluations (this characteristic was not universally applied among the interventions summarized).

PROGRAM SUMMARIES

Academic enrichment programs which strive to assist minority/disadvantaged students, usually fall into two broad categories:

- structured short-term (3 to 8 weeks) summer programs; and,
- structured longer-term (12 to 15 months) programs that usually operate during the academic year or during the summer and academic year.

For the **Program Summary** section of this report, each of the selected sample programs[43] will be presented in the format of:

A: Program Overview
B: Program Outcomes

Xavier University, SOAR (Stress On Analytical Reasoning) Program:

A. Program Overview:

The educational literature and the Xavier University HCOP progress reports strongly suggest that the HCOP program[44] at Xavier, the Summer Science Academy, has been effective in cultivating and nurturing critical thinking, problem-solving, and test-taking skills of minority/disadvantaged students pursuing careers in the health professions. The most significant evidence of a program's capability to cultivate these skills is demonstrated by statistically significant increases in participant grades and MCAT scores which aid these students in becoming more competitive for acceptance directly into a regular (full curriculum) freshman medical, dental or pharmacy class. The Summer Science Academy is open to minority/disadvantaged high school and college students who express an interest in pursuing a health professions career (Medicine, Osteopathy, Dentistry, Veterinarian Medicine, Optometry, Podiatry or Allied Health).

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[43] More extensive details for selected components of each program can be found in Appendices 10-13.

[44] HCOP contributes to the funding support of the Xavier Summer Academy. HCOP funding is earmarked for Project SOAR, the component of the Summer Academy that targets rising high school seniors and entering college freshmen.

The Summer Science Academy is a multi-tiered and multi-year summer program which assists URM students at various stages of the educational pipeline.

- **Math Star**, course work focuses on providing URM students with a basic understanding of the principles of algebra and trigonometry.
- **Biology Star**, course work provides URM students with an introduction to vertebrate and invertebrate science.
- **Chem Star**, through a combination of classroom lectures and laboratory exercises, URM students learn the basics of the chemical sciences.
- **Project SOAR** (Stress On Analytical Reasoning) is actually the last stage of the Summer Science Academy's academic enrichment process and provides rising high school senior and rising college freshmen students with skills development courses that are linked to college level math, biology and chemistry.

Project Soar was designed as an interdisciplinary effort between Xavier University's math, biology and chemistry faculties. In addition to traditional classroom assignments with strong emphasis on vocabulary and reading skills, the program includes small group based problem-solving exercises, peer discussions and competitions which develop independent thought and enhance independent learning. Successful program participants serve as role models and group leaders. Parental involvement has also proven to be a key factor in the success of all the programs sponsored by the Summer Science Academy.

B. Program Outcomes

Xavier provides the following evidence that supports the claim that its HCOP Program has been effective (also see Appendix 10):

- The number of students from the Xavier program who gained entry into health professions school almost tripled, from an average of 44 per year in 1976–1978 to an average of 131, between 1990–1993.
- Xavier currently (1994) places more African-Americans into pharmacy school and into medical school than any other academic institution.
- In the SOAR program, Nelson-Denny Reading and PSAT post-participation tests show consistent gains over pre-participation tests each year from 1985 through 1993.
- The Pharmacy Pre-matriculation Program has produced statistically significant

data that shows more students have been passing courses such as pharmacy calculation and medicinal chemistry since the program was established.

- The summer program participation has been associated with a reduction in the drop-out rate from the pre-medical curriculum -- from 43.6% in 1984, to 15.1% in 1993.

The Supplemental Instruction Program:

A. Program Overview:

The Supplemental Instruction Program™ (SI) was designed by Deanna C. Martin, PhD., during 1972 and 1973. The stimulus for the program's development can be traced to the academic difficulty experienced by minority and other disadvantaged medical, dental and pharmacy students attending University of Missouri at Kansas City (UMKC). Initial funding for the SI program was provided by the Office of Health Manpower Opportunity (OHMO), through the Special Health Careers Opportunity Grant (SHCOG) program (see Appendix 5).

Following the success of the initial SI program, which was open only to UMKC's health science students, the program was extended to other schools throughout the institution. Currently, over 500 educational institutions, nationally and internationally have made the Supplemental Instruction Program, or some adaptation of it, an optional part of their curriculum.

After a rigorous review process in 1981, the SI Program became one of the few post-secondary programs to be designated by the U.S. Department of Education as an Exemplary Educational Program. It is the only education program that has been certified by the Department of Education as an Educational Retention Program. The National Diffusion Network, the dissemination agency for the U.S. Department of Education, has provided federal funds to support a national SI data bank which compiles, analyzes and disseminates reports to the hundreds of educational institutions across the nation that participate in the network.

The following critical components are strongly recommended by SI's creators:

- The SI intervention should focus on high-risk courses (those courses with an unacceptably high rate of grades of D, F, and Withdrawals) rather than on high-risk students. In this way the program allows the student to avoid the stigma associated with participation in traditional academic assistance programs.

- Student participation should be voluntary with rare exception.

- Faculty that are both supportive and involved need to be identified.

- Students (usually successful upper class or graduate students), not faculty, should be used to facilitate the learning group.

- Skills development exercises should be integrated with course content;

- For each subject matter needing reinforcement, three or more hours per week of SI should be allotted.

- The length of each SI program should be directly proportional to the length of the course (quarterly, semester or academic year).

- Training and supervision of the facilitator should be mandatory.

B. Program Outcomes:

The following findings are statistically significant and cut across race, gender, age and comparable academic credentials (also see Appendix 11):

- Students participating in SI, within the institution-targeted high risk courses, have exhibited higher mean final course grades than students who do not participate in SI.

- Students participating in SI within targeted high risk courses succeed at higher rates (withdraw at lower rates, and receive a lower percentage of D or F final course grades) than those who do not participate in SI programs.

- Students participating in SI programs persist at the institution (re-enrolling and graduating) at higher rates than students who do not participate in SI programs.

In general, SI participation produced a statistically significant positive change in academic year course achievement. The average effect was conservatively estimated as a third (and is more likely about a half) of a standard deviation in the course test score distribution. The results, outlined above, have been replicated hundreds of times within a wide variety of higher educational settings, both nationally and internationally.[45]

A HCOP funded post-baccalaureate program earmarked for URM students has successfully incorporated Supplemental Instruction into its curriculum in 1992. This program, the **Advance Baccalaureate Learning Experience (ABLE)**, reported that the minority students enrolled in the program showed the same gains as other SI students when their grades were compared to the grades of other minority and non-minority students who did not attend SI sessions.[46] The effectiveness of SI has made it easier for the Michigan State College of Human Medicine to maintain an admission policy that brings a diverse student population to the college and that ultimately adds to the diversity of the medical profession.

Lastly, the program has been found to be cost effective to implement. The average expenditure per student for the traditional Supplemental Instruction Program is approximately $100.

USMLE Preparation at UMKC

A. Program Overview:

The University of Missouri at Kansas City (UMKC) preparatory programs provide educational enrichment. These derive from original funding from the Office of Health Manpower Opportunity, under a Special Health Careers Opportunity Grant (SHCOG). Although no longer funded by HCOP, all UMKC programs continue to assist minority students.

Board Preparation (21 Weeks, January-June). This program assists students who have previously failed the Step 1 of the United States Medical Licensure (USMLE) examination, especially those with repeated failures. Board preparation incorporates the standard Supplemental Instruction (SI) Program but differs in key respects:

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[45] Review of Research Concerning the Effectiveness of SI from the University of Missouri-Kansas City and Other Institutions from Across the United States. (1994). National Center for Supplemental Instruction, UMKC. Kansas City, MO.

[46] Bridgham, R. and Scarborough, S. (1992). "Effects of Supplemental Instruction in Selected Medical School Science Courses." Academic Medicine Journal. 67(10), 569-71.

- it is designed to review courses already taken;

- it is designed to prepare students for the USMLE and not for a course grade;

- participation in all program components is mandatory;

- interactive learning groups are generally composed of no more than 10 students;

- facilitator led interactive groups meet an average of 60 hours per week in contrast to the 3 hours per week allocated for SI groups;

- there are preview sessions prior to lectures in basic science medical school courses;

- question based tutorials which focus on the syntax and the semantics of both board type questions in addition to the scientific content.

Students who have previously failed Step 1 are most receptive to the UMKC FirstPrep curriculum design. This is particularly true for "at risk" students since most are insecure about their academic status and tend to be fearful of adopting new or different approaches to learning.

Board Preparation (7 Weeks, May-June). FirstPrep is a video-based program designed to assist students who are preparing for the June USMLE Step 1. This program is offered on the UMKC campus as well as campuses outside Kansas City. Currently, FirstPrep is offered at 20 sites in the United States and abroad. A four week program for 10-15 students would cost approximately $700 - $1000 per student, inclusive of all teaching and materials costs (the cost does not include student stipends).

Board Preparation (7 Weeks, August-September). This program, a shorter version of the January-June offering, is designed for any student who desires a structured review for the September USMLE Step 1. Special consideration is given to students who failed the previous June examination with scores of 165 or higher and expect to re-test in September.

Step 2 and Step 3 USMLE video-based reviews are currently in preparation for use in Kansas City and at other campus sites. It is expected that these reviews will be available in 1996.

B. Program Outcomes:

The UMKC programs appear to be the only standardized test preparation programs that offer hard statistical data indicating their success at significantly increasing the standardized test scores of the majority of high risk students who participate in the program (also see Appendix 12):

- Nearly 100% of program participants, who have previously taken National Board Part I or USMLE Step 1 have improved their scores after program participation. The majority of score gains are statistically significant.
- Nearly all students who did not pass USMLE Step 1 following their participation in FirstPrep were able to pass on the next administration after participating in the Board Preparation (7 Weeks, August-September) program.
- The brief FirstPrep program is not designed to fill in large knowledge gaps in a short period, nor will the FirstPrep program likely enable someone with very low scores to succeed on re-test.

The Georgetown Experimental Medical Studies (GEMS) Program:

A. Program Overview:

The Georgetown Experimental Medical Studies (GEMS) Program is a post baccalaureate program that currently only operates during the academic year. The primary academic support vehicle is a modified version of the "Supplemental Instruction" program. Although not currently funded by HCOP, HCOP funds were instrumental in enabling the development of a curriculum that emphasized collaborative learning. Since implementation of this curriculum, the GEMS program has been more effective in assisting minority/disadvantaged students to achieve strong pass grades in all basic science medical school courses, and a 90-95 percent pass rate when USMLE Step 1 is taken for the first time.

The participants of the GEMS program do not pay a tuition or a fee. They take approximately 50 percent of the regular freshman medical curriculum during the academic year. Lectures on embryology, biochemistry and physiology are supplemented by three hours of monitored self-learning and three hours of facilitator-led small group interactive learning everyday.

The primary costs of this program are those associated with a part-time facilitator ($20,000/year) and with copying and supplies
($3,000/year). Special faculty support-time, used primarily to clarify concepts, averages 20 hours per academic year.

B. Program Outcomes:

The GEMS program has been in operation for 16 years during which time the following has occurred:

- Two hundred and sixty (260) minority/disadvantaged students have completed the program. The completion rate has improved since collaborative learning strategies were integrated into the curricula.
- Two hundred and twenty-six (226) of the 260 students or 90 percent of the GEMS students have gained acceptance to an American medical school. The medical school acceptance rate has also improved since adoption of collaborative learning approaches.
- Two hundred and four (204) of the 226 (90%) who gained acceptance to a medical school have either graduated or are still enrolled as medical students.
- Close to 90 percent of all GEMS students pass all basic science courses and Step 1 of USMLE on their first attempt. The first attempt pass rate of USMLE Step 1 has also improved since adoption of collaborative learning approaches.

The GEMS program has produced measurable data which strongly supports claims that selected HCOP-supported learning strategies are effective in making students, 'at relative academic risk' or with 'marginal' academic credentials, competitive in medical school courses and on Step 1 of USMLE.

It is important to note as well that GEMS underscores why the definition of student 'risk' must be program, or institutionally, defined. It is extremely unlikely that students with the academic profiles of those enrolled in the GEMS program could perform at acceptable levels if they had to start their medical school experience by taking a full course load. It is likely that their academic performance has been enhanced by the fact that they spend 50 percent of their time during the first two years of medical school on activities devoted to the better understanding basic science concepts in concert with problem-solving and critical thinking exercises.

Additionally, the format and outcomes of this program do not differ greatly from those of the Video-Based Supplemental Instruction program. That program was able to generate impressive academic outcomes by reducing the formal academic course load and requiring the students to participate in monitored collaborative learning activities for time periods that equaled regular course time.

Video-based Supplemental Instruction and the Mathematics Workshop Program

The final two program summaries included in this report were not initially designed or implemented with HCOP funds. However, the statistically validated successes each has demonstrated, together with the fact that they target 'students with traditionally low academic standings' and 'historically difficult courses,' indicates that they should be considered for greater application. The first of these approaches is called VSI, which stands for Video-based (taped or assisted) Supplemental Instruction. VSI has been adapted by numerous supplemental education programs since its inception in an effort to assist college athletes in attaining passing grades.

The last program highlighted is the Mathematics Workshop Program or MWP. This approach utilizes small study groups where students work together to identify responses to challenging mathematical problem sets.

Both of these programs have been included because they can serve as guides for the integration of learning strategies which would result in an enhancement of HCOP efforts.

The Video-based Supplemental Instruction (VSI) Program:

A. Program Overview:

Video-based Supplemental Instruction, as a stand-alone program, evolved from the University of Missouri at Kansas City's (UMKC) goals of improving the quality of the academic enrichment gained by its varsity athletes (many of whom were minorities). The results presented under the outcomes section come from Kansas City's initial implementation of the program, in conjunction with a course on Western Civilization, in the Fall of 1992. The key components of the VSI approach implemented by the University of Kansas City include the:

- Selection of a well respected professor who teaches a historically difficult course (typically 20-30% of students in class receive grades of D or F);

- Videotaping of all lectures included in a course;

- Assignment of additional credit to the class, in the case of UMKC's program, six credit hours were given - three for the core course components and an additional three for the supplemental instruction included in the overall VSI approach;

- Administration of the same exams to both regular course and VSI course participants at the same time and grade the results against the same standards; and,

- Utilization of a facilitator who has extensive familiarity with the subject matter of the course; and, who is experienced in the techniques of VSI and collaborative learning.

B. Program Outcomes:

During the pilot phase of this program, 18 students enrolled in the VSI section and 157 students were enrolled in the regular course. The results were examined with respect to several variables because course grades alone were not sufficient to measure all aspects of the program. The following results were reported:

- Ninety-five percent of the VSI group earned A or B grades and none received D's or failed. In comparison, 24 percent of the regular class either received D's or failed.

- The average grade for VSI students was 3.6 (4 point scale) in comparison to 2.3 for those students in the regular course.

- All but one of the VSI group members, including students on academic probation, re-enrolled in the university for the following semester. In contrast, 85 percent (including only 45 percent of those on probation) of the regular class re-enrolled in the university for the next semester.

Mathematics Workshop Program (MWP)

A. Program Overview:

The literature also surfaced information about an evaluation, conducted between 1978 and 1985, of The Mathematics Workshop Program (MWP) at the University of California at Berkeley (UCB). This program, which was a component of the University's Professional Development Program (PDP), has particular relevance to this research because of its focus on the use of collaborative learning approaches to master math concepts pertinent to health professions curricula.

The MWP was billed as an honors program that recruited first-year students of all races, though typically, 80 percent of those enrolled were African American and Hispanic. The designation of MWP as an honors program was an important part of the strategy in recruiting and motivating students to participate in the program. This designation avoided the stigma of participation in a remedial course, encouraged the students to gain assistance in a challenging subject area, earlier in their educational process and assisted them in building self-esteem.

Once enrolled, students discovered that the program functioned very much like the discussion section that accompanied their mathematics lectures. What distinguished each workshop from a standard mathematics discussion section, was the fact that the workshop's 20-30 participants were organized into groups of 5-7 students. Each group worked together for approximately two hours, twice a week, on work sheets containing carefully constructed and challenging problems.

The work sheets were the core of the program's efforts to provide students with three benefits: 1) the skills to earn a final grade of A in first-semester calculus, 2) a foundation in mathematics that will enable MWP graduates to continue to excel in second semester calculus and upper-division mathematics (without the assistance of the program), and, 3) opportunities to identify areas in mathematics knowledge that students must strengthen to survive and excel.

B. Program Outcomes:

Prior to the establishment of the MWP, Chinese students generally excelled in mathematics while a large percentage of the African American students failed. In 1976, for example, 40 percent of the African American students enrolled in Mathematics 1A earned grades of D-plus or lower. The data indicates that the MWP program has been associated with significantly more positive outcomes for minority students (also see Appendix 13):

- A total of 131 African American students completed the course in the five-year period between 1973-77; by contrast, the succeeding five years saw a dramatic increase in the numbers of African Americans both enrolled in and earning passing grades in this course.

- The failure rate among students prior to the establishment of the MWP was 33 percent. The failure rate after the establishment of the MWP ranged from 3-5%. This difference was significantly significant in comparison to the two groups of non-MWP students.

- MWP students were two to three times more likely to earn B-Minus or better grades than non-MWP students, irrespective of the year enrolled.

MAJOR FINDINGS

To summarize, the research presented in this report indicates that participation in collaborative learning sessions is associated with earning higher course grades, greater persistence in college, higher science grade point averages, and higher graduation rates from health professions schools.

The most significant interventions are those that can be shown to be effective in assisting students, who are at relative academic risk, to obtain grades and standardized test scores that are competitive for acceptance into, and timely graduation from, health professions schools. Nearly all of the approaches demonstrating validated, statistically significant evidence of impact on academic year grades and standardized test scores included collaborative learning techniques as a common feature.

In regards to the directive under Task 10 (evaluate and identify specific successful HCOP program approaches) of the research contract, the comparability of data and the level of tracking is not sufficient for the majority of HCOP funded programs to ascertain which strategies are directly responsible for improvements in participants scores and grades.

Educators believe that collaborative learning approaches enhance a student's ability to acquire information and recall it at some later time, discover and solve problems, and use reasoning to support conclusions. The documented effectiveness of collaborative learning in assisting students, who are at relative academic risk, to obtain competitive grades and/or standardized test scores, coupled with the low per student costs associated with the approach, suggests that many, if not most of the HCOP-funded programs should consider adopting this learning strategy.

Minority/disadvantaged students will not achieve competitive grades in math and science until their cognitive skills level can be significantly strengthened. The achievement of competitive grades by 'relatively at-risk' students participating in collaborative learning activities suggests that the learning approach has the twin ability of showing students how to acquire and use the information they have gained. This has a direct correlation to the interests of HCOP projects in targeting their resources towards those intervention strategies which are most likely to positively impact the skills minority/disadvantaged students need to successfully compete for entrance into and timely graduation from, health professions schools.

CHAPTER VI

ALL-INCLUSIVE LISTING OF RECOMMENDATIONS, RELATED GUIDELINES AND RATIONALES

The HCOP Work Group (HWG) brought together for this analysis feels that the Program's future success is closely aligned with the Division of Disadvantaged Assistance's (DDA) ability to encourage Grantees to pool data and experiences leading to the ability to better assess the effectiveness of their collective programming. One of the overall goals of this collaboration is to bring together statistically valid data which aids the assessment of relative levels of academic risk, identifies effective interventions and productively communicates the results. The HWG discussion focused on how to best provide leadership for future program initiatives, and to ensure that these initiatives benefit from the knowledged gained from efforts made in the HCOP projects that preceded them. The following recommendations, guidelines and rationales reflect the sentiment of the HWG participants and many minority medical educators who are familiar with this project.

While each section of the report provided targeted recommendations, those included in the Introduction were developed within the context of 'global' and 'systemic' change, as such, they overlapped some of the more focused recommendations included in subsequent chapters. This overlap was intentional in order to ensure that all proposed enhancements to the program were interconnected and supportive.

In order to facilitate the utility of this report, the guidelines have been organized into categories. The following groupings reflect the type of effort each guideline would support: **Process Guidelines** pertain to activities which would enhance the operation of HCOP projects; **Cognitive Guidelines** relate to skills assessment and development impacting those abilities which are traditionally measurable, such as science knowledge; **Non-Cognitive Guidelines** reflect the issue that in conjunction with cognitives, non-cognitives, such as a student's drive to succeed, should be incorporated into all HCOP efforts.

CHAPTER I: INTRODUCTION

# 1 Encourage all HCOP Grantees to incorporate HCOP in their program name/title, in a manner which is appropriate within the context of their individual projects. There is an urgent need for Grantees to develop practices that better enables students, advisors and resource allocators to know that HCOP provides funding and technical support for the program.

Process Guideline #1-A:
Grantees should minimally integrate HCOP into their title, for example: The *** HCOP project, or, The *** project, funded or partially-funded, by HCOP. The appropriate mode of incorporation may reflect the relative contribution of HCOP resources in complement to additional funding sources. Within this context, program participants should also be clearly identified as HCOP participants. One way to approach this action is through the identification of participants as "HCOP Fellows" (concept is detailed further in Chapter IV).

Process Guideline #1-B:
Grantees should ensure that when appropriate and cost-effective, any form of product or communication (purchased with HCOP funds) clearly indicates HCOP's association with the program. This should pertain to letter-heads, brochures and program applications, as well as, project reports and publications.

Rationale: This is needed to increase name recognition of HCOP efforts, and, to aid in the tracking and reporting on the formal role HCOP plays in preliminary education, facilitation of entry and retention of minority/disadvantaged students in health profession schools. Additionally, the incorporation of the HCOP name in any form of communication is in keeping with federal regulations and standards for the identification of government-funded efforts.

# 2 Encourage HCOP Grantees to utilize both cognitive and non-cognitive variables in the selection and the matching of programs to participants.

Process Guideline #2-A:
Grantees should select students based on a program specific standardized index (discussed in Chapter III -- samples are provided in the appendix section) that incorporates both cognitive and non-cognitive variables.

Process Guideline #2-B:

These variables should be weighted, preferably, by means of regression formulas that place relative values on each variable which the project feels significantly influences the academic performance of HCOP participants.

Process Guideline #2-C:

The weights assigned to cognitive and non-cognitive variables should be set in terms of relative risk levels, including those which reflect the perspectives of individual teaching faculties and program directors.

Rationale: The educational literature confirms that a combination of non-cognitive variables coupled with cognitive variables, such as grade point average and standardized test scores, is the most reliable way to predict most minority/disadvantaged students' readiness to compete effectively in health professions schools. A Selection Index based on weighted cognitive and non-cognitive variables will enable Grantees to better define the relative risk levels of students, which will vary from program to program. Program resources, particularly financial and faculty support, go far in determining the student risk levels a program can reasonably support. A Selection Index based on weighted variables will allow each Grantee to uniquely define student risk levels in quantitative terms. Additionally, clearly defined risk levels will enable Grantees and DDA to better assess the impact of HCOP funded interventions on students at academic risk.

# 3 DDA should encourage the development of a "universal minimum data set" (as discussed in Chapter IV) applicable to most college and health professions school HCOP programs which includes both cognitive and non-cognitive variables. DDA should additionally encourage programs to include questions in all participant applications which will elicit the necessary data.

Process Guideline #3-A:

DDA should provide all HCOP Grantees with a computer disk that contains a Minimum Data Set 'Template' (also referenced in Chapter IV) and encourage all Grantees to utilize it to facilitate their data collection efforts..

Process Guideline #3-B:

For example, the template should include, but not be limited to, some of the following data elements --

- Demographic Data: name, gender, date of birth, ethnicity, citizenship

- High School Data: standardized test scores (eg SAT, PSAT), class rank, course grades

- Undergraduate/Graduate/Post-Baccalaureate Data: science grade point average by class year, cumulative grade point average by class year, standardized test scores (eg GRE, MCAT, DAT), course grades, institutional competitiveness

- Intervention Data: participation in academic enrichment programs (summer and/or academic year) and post-baccalaureate programs.

Rationale: This computer disk containing a Minimum Data Set Template, could serve as a guide and tool for the collection, maintenance and communication of a minimum of standardized cognitive and non-cognitive data deemed important in defining minority/disadvantaged student academic and non-academic needs. It would also be useful in predicting their potential for benefitting from participation in a HCOP funded program.

# 4 Encourage HCOP Grantees to become familiar with collaborative learning approaches, to use them in a way that can best be supported within their existing resources, and, are most appropriate in meeting the needs of their participants.

Process Guideline #4-A:
At the annual technical assistance conference, DDA could make copies of the bibliography of this research paper, available to prospective applicants who are interested in doing further research on the models and approaches relative to minority/disadvantaged support programs.

Rationale: This is needed in light of the research and analysis presented in this report which indicates that collaborative learning is one of the few learning approaches that has been shown to be statistically effective in improving the higher educational (college and health professions school) grades, standardized test scores and retention rates of Underrepresented Minority (URM) students.

#5: Support the establishment of a "National Student Academic Enrichment Match Service Center (NSAEMSC)," within the private sector, which will attempt to match a student's aspirations (medical school, dental school etc), academic profile, existing financial circumstance, grade level and geographic location, with the curriculum and support service programs or courses which best address his/her needs.

Process Guideline #5-A:
NSAEMSC would encourage student applicants to voluntarily submit key 'selection indicators' (detailed in Chapter III - such as GPAs, standardized test scores, grades in specific science and math courses, etc.) to the "Center" as a basis for the match assessment process.

Process Guideline #5-B:
NSAEMSC would encourage Grantees to submit specifics related to their respective curricula that identify format(s) (e.g. facilitated small groups, lectures), size of classes, subjects (including the amount of time earmarked for each subject), average GPA together with the standardized tests scores of past participants.

Process Guideline #5-C:
NSAEMSC would charge students a fee to help support the Center's activities in addition to seeking foundational grants.

Rationale: Currently, students are in no position to effect such matches on their own and available information on HCOP funded programs does not provide counselors or mentors with enough intervention-specific information to allow them to effectively match the individual needs of students to available enrichment resources. There is no question that hundreds of minority/disadvantaged students are desperate for technical assistance and advice. Many do not know where to direct their scarce resources and look to HCOP supported minority medical educators for guidance. Students often report obtaining contradictory advice from those sources. This is true because the HCOP funded minority medical educators are themselves unaware of the specific curricula or learning approaches offered by HCOP funded programs other than their own. Even when that information is known, they are not likely to know specifics about the academic profiles of the students who participated in other HCOP projects or specifics on the effectiveness of those programs. There is an urgency to better inform the students and their advisors, inclusive of HCOP funded minority medical educators.

A more effective and efficient method would be to establish a national match service that would serve a function not unlike that of the National Intern and Resident Match Service. It would not have to be sophisticated or costly. This service is urgently needed since students are not in a position to effect such matches on their own, and currently, the available information on programs does not allow counselors or mentors to effectively respond to individual needs of students.

#6. Establish a Standing Guideline and Diagnostic/Intervention Review Committee which includes, to the extent possible:
a) HCOP Grantee staff b) recognized, technical experts in student testing, c) known authorities on cognitive learning strategies and d) program evaluation specialists.

Process Guideline #6-A
This can be accomplished through the configuration of the peer review panels to ensure that each of these skills is effectively represented.

Process Guideline #6-B
Develop guidelines that will assist Grantees in selecting the types of developmental skills personnel (see Chapter II), most likely to be effective in improving the cognitive skills of "at-risk" minority/disadvantaged students.

Cognitive Guideline #6-C
Develop guidelines for reading, critical thinking and problem-solving skill programs that detail at minimum;
a) the number of hours of instruction to be provided; b) the teaching format (e.g. size of student group);
c) strategies for the effective linking of developmental efforts with science content domains; and, d) methods for evaluating the effectiveness of cognitive skills developmental approaches.

Process Guideline #6-D
To the best of its ability, DDA should enable the committee to review at least, a random number of grant applications and progress reports each year.

Rationale: A Standing Guideline and Diagnostic/Intervention Review Committee would have the expertise to provide advice on standards and guidelines used for student selection, program design, tracking and evaluation. The HCOP Grantee Work Group (HWG) indicated that many Grantees are interested in collecting more extensive validated data and participating in collaborative efforts designed to better analyze the effectiveness of their respective programs. Unfortunately, only a few Grantees have the financial or manpower resources to do so. Additionally, the Committee could provide a source of technical assistance consultants which the programs and their institutions could employ to assist in the design and maintenance of their efforts.

#7. Encourage the establishment of a private sector based "Data Exchange Clearing House (DECH)" which compiles, analyzes and disseminates reports related to data on program interventions and outcomes. This information will better enlighten HCOP grantees about the cognitive and non-cognitive factors that contribute most to the success of HCOP funded programs in aiding minority/disadvantaged students to become more academically competitive for health profession school entry, retention and graduation.

Process Guideline #7-A:
DECH would encourage student applicants to voluntarily submit data (GPAs, standardized test scores, grades in specific science and math courses etc.) to a central clearing house.

Process Guideline #7-B:
For those HCOP programs in need of assistance in processing data and/or developing selection indices, the clearing house could also provide this function.

Cognitive Guideline #7-C:
DECH would encourage all Grantees to submit specifics related to their respective curricula that identifies format (e.g. facilitated small groups, lectures) and size of classes, subjects and the amount of time earmarked for each subject, average GPA and standardized tests scores of past participants.

Process Guideline #7-D:
Distribute fully the results of AAMC's MCAT Validity Study to HCOP instructors, counselors and student advisors to assist in the communication of realistic short term program goals.

Rationale: The HCOP Work Group was unanimous in the opinion that DDA should encourage the establishment of a process that will better assess the effectiveness of grantee interventions or learning approaches. The medical education literature shows a paucity of reports that confirm the effectiveness of the various learning approaches used in HCOP funded programs in improving the academic competitiveness of students who participate in these programs. Even though intuition suggests many of the approaches may be effective, there is a need to confirm these beliefs with hard data. Such a confirmation will necessitate HCOP funded programs working cooperatively and systematically together to compile and subsequently analyze the cognitive and non-cognitive variables which influence academic performance.

AAMC studies together with the educational literature indicates that the mean increase for student cohorts was not sufficient to move from one cohort to another. Obviously, within each cohort group, the AAMC study did show individual examples of significant increases.

#8. DDA should encourage the development of a tiered academic enrichment system that provides highly motivated, minority/disadvantaged students an opportunity to cultivate their cognitive skills under guidance over time. In addition, DDA should support the establishment of at least one tiered program specializing in cognitive skill development within each region of the United States.

Process Guideline #8-A

Establish the levels of the tiered academic enrichment system as follows: Level 1 should focus on basic math, reading, writing and test taking skills linked to general biology or physical science content domains. The curriculum design for this approach should place a priority on skills development; Level 2 should build on the components of Level 1 and include additional emphasis on problem solving and critical thinking skills; and, Level 3 should proceed along the continuum of development from Levels 1 and 2 as well as include structured exercises to improve the participants' potential to score well on standardized tests.

Process Guideline #8-B

Give preference funding to those HCOP applicants that can demonstrate an ability to affect a tiered academic enrichment system within the geographic region where their program will operate.

Process Guideline #8-C

Establish as a priority the development of intensive, residential summer programs (6 to 8 weeks) which concentrate activities around the nurturing and enhancement of cognitive and non-cognitive skills in conjunction which math and the sciences. These programs should incorporate a minimum of twelve hours of facilitator-led small group learning sessions and utilize, when ever possible, video-taped instruction.

Process Guideline #8-D

Encourage community based organizations, community colleges or undergraduate schools to be participants in vertical system enrichment programs (those which target rising high school seniors and/or college freshmen, sophomore or juniors). Additionally, have applicants include evidence that their program has a formal linkage agreement with a health professions school.

Process Guideline #8-E

Such programs should be targeted to the highly motivated, bright freshman and sophomore students who have Science GPAs ranging from 2.0-3.0 and SAT scores ranging from 800-1100. The students should understand that it may take 2-3 cycles of "a summer and an academic year" of cognitive skill building before they can be reasonably assured that they would be competitive in a health professions educational setting.

Non-Cognitive Guideline #8-F

Admission to the 'base' programs should be restricted to students who evidence a realistic appraisal of their need to improve basic cognitive skills as determined by interview or essay and non-cognitive diagnostic tests.

Rationale: More examples of formal collaboration are needed between HCOP efforts and between the individual programs and the educational community in which they operate. By placing greater focus on the creation of tiered relationships, HCOP can ensure that skills development does not end at the door of an individual project. Just as critical to the success of HCOP programs is the selection of students who are realistic about the developmental status of their cognitive skills. In particular, students who can realistically gage these skills relative to the developmental status of those who will compete with them on standardized exams, for an acceptance to an health profession schools and for grades once inside the school. Many minority/disadvantaged students are willing to accept the fact that there is no quick solution to their problem and are willing to commit 2-3 years working on cognitive skill building and science content mastery if it seems likely that they will be competitive for health professions school entry at the end of that period.

Additionally, summer residential programs are ideal for implementing interventions that promise, or have been proven, to be effective in nurturing the development of problem-solving, critical thinking, conceptual skills and standardized test-taking skills of 'at-risk students. Residential HCOP academic enrichment programs for high school and college students that are six to eight weeks in length, that operate somewhat like 'boot camps' in format, appear to be effective in detecting weaknesses and strengths in cognitive and non-cognitive attributes of the program participants. Several such programs have produced data that strongly suggests they may be effective in introducing students to developmental processes that are critical to the eventual strengthening of problem solving, critical reasoning, conceptual skills and standardized test taking skills. Two programs which have received much publicity are the Drew Summer MCAT Program and the SOAR program at Xavier University.

CHAPTER II: EFFECTIVE LEARNING APPROACHES.

#1 Encourage grantees to implement learning approaches that have been shown to be statistically effective in improving student comprehension and conceptual understanding of lectures and textbook material.

Process Guideline #1-A

At the technical assistance conference, provide prospective Grantees with a copy of the bibliography from this research.

Process Guideline #1-B

Circulate, in hard copy or via internet (possibly in conjunction with technical assistance from the Data Exchange Clearing House proposed in the Introduction), examples of effective approaches.

Rationale: Since 1972, DDA has funded hundreds of projects designed to assist minority/disadvantaged students interested in pursuing careers in the health professions. Unfortunately, the majority of the projects have not produced statistically significant data that confirms a correlation between these learning approaches and the improved college and health science school grades or improved standardized test scores of minority/disadvantaged students. Chapter V of this report presents program summaries of several learning approaches, some not funded by HCOP, that have presented statistical evidence supporting their ability to improve the academic competitiveness of minority students. The 1994 Evaluation of HCOP Summer Programs indicated that fewer than 16% of those programs emphasize the learning methods that have been proven to be effective. This information, coupled with the fact that some of the approaches were developed with HCOP funding support more than 20 years ago, strongly suggests that there is a need for more aggressive efforts of disseminating historically proven, statistically valid intervention models.

#2 Encourage all grantees to become familiar with collaborative learning approaches; and, to adopt those approaches which can best be supported by their existing resources and are most appropriate for the students targeted by their program.

Process Guideline #2-A
As part of a HCOP 'pipe-line' approach (noted under the recommendations listed in the Introduction), integrate intensive six week summer programs within a 'tiered' structure which includes interactive 'boot camp-like' intervention programs.

Cognitive Guideline #2-B
Utilize some form of video-based interactive/assisted learning (such as the VSI program) and/or Supplemental Instruction (SI) as a programming component whenever existing resources support its inclusion.

Cognitive Guideline #2-C:
Whenever possible, HCOP course work, particularly skills development components, should be directly linked to science domain course work. In addition, facilitator-led small group interactive learning should be emphasized whenever possible.

Non-Cognitive Guideline #2-D:
Using LASSI and the Non-Cognitive Questionnaire (NCQ, a revised version is currently being developed) to define student personality types and to better match students for interactive group discussions and study sessions.

Rationale: Based on a review of the literature together with analysis of HCOP progress reports, these program components have been linked with improvements in student academic achievement. Chapter V highlights some of the approaches used by programs, which appear to support the relative benefits to be gained by incorporating these components.

#3 DDA should minimally earmark funds to support at least one Grantee in each region that has as its objective the improvement of HCOP Participants' scores on the science and math portions of standardized tests; and, makes a commitment to use collaborative learning approaches to improve basic arithmetic operations.

Cognitive Guideline #3-A:
Grantees that make a commitment to concentrate on improving performance of minority students within the math portions of standardized tests through the use collaborative learning approaches, should commit at least 12 hours/week towards the development of basic arithmetic skills. These skills include, but are not

limited to: addition, subtraction, multiplication, simplifying algebraic equations, proportional analysis of algebraic equations, percentage increase or decrease problems, graphic analysis of functional, exponentials, slope, or rate of change problems.

Cognitive Guideline #3-B:

Grantees that make a commitment to concentrate on improving the performance of minority students within the science portions of standardized tests, through the use collaborative learning approaches, should commit at least 12 hours/week towards deductive and higher forms of reasoning in conjunction with organic and inorganic chemistry, physics and biology.

Process Guideline #3-C:

Within this context, grantee instructors should link basic arithmetic skills development efforts with the content domains of chemistry and physics.

Non-Cognitive Guideline #3-D:

It will not be enough to "just" devote more time to basic math. Programs need to incorporate collaborative/interactive approaches (similar to those detailed in Chapters II and V of this report) into their interventions which lead to the enhancement of students' confidence in attempting math, chemistry and physics problems.

Rationale: The Med-Mar MCAT Minority Student Registry suggests a significant number of medical school applicants who score 4 or less on physical science MCAT sub-test are URM students. Since the physical science portion of the MCAT emphasizes chemistry and physics, the summer program curriculum of many HCOP funded programs tend to emphasize those two subjects rather than on basic arithmetic operations and deductive reasoning. The students, and too often the HCOP project personnel, attempt to address the problem of low physical science MCAT sub-test scores by means of a rapid review of math, chemistry, and physics during a 6 week summer program. The students are exposed to many complex science and math concepts (and too little thinking process) over too short a period of time. Not surprisingly, students often leave summer programs with conspicuous weaknesses in basic arithmetic operations. As a result, they obtain essentially the same low physical science MCAT sub-test scores when they repeat the exam.

An analysis of the commercial and non-commercial MCAT diagnostic tests reveals that, in spite of the students' college-level math grades, most minority/disadvantaged students are weak in the basic arithmetic operations necessary to solve chemistry and science problems efficiently and correctly.

The approaches outlined in the guidelines above are more likely to improve students' physical science MCAT sub-test scores, especially, if they continue to practice the problem-solving exercises in a collaborative learning format (e.g. pair problem-solving).

#4 Grantees should be encouraged to sponsor reading interventions that emphasize evaluation, application, and the incorporation of new information.

Process Guideline #4-A:
Applications incorporating reading interventions should outline the following considerations within the backgrounds of the instructors and selected interventions:

- Specific types of reasoning and problem solving skills measured by standardized tests;
- The number of hours of instruction to be provided;
- The types of methods to be used;
- The types of pre- and post-tests to be used; and,
- How the results of the pre- and post-tests should be interpreted.

Process Guideline #4-B:
Grantees should instruct all HCOP participants, who are preparing for an upcoming standardized exam, to read the AAMC MCAT Student Manual carefully; and, Grantees should set-aside time for a test expert to discuss "key" points in the manual with the student participants.

Rationale: There is no easy way for the administrative staff of HCOP programs to reliably evaluate the potential effectiveness of 'reading specialists' or 'reading instructors.' Unfortunately, many of the available instructors tend to emphasize vocabulary, reading comprehension, and reading speed at the expense of the evaluation, application, and incorporation of new information items.

The *MCAT Student Manual* (AAMC) points out that over 70% of the MCAT verbal reasoning score is based on skills in evaluation, application, and incorporation of new information test items. Minority/disadvantaged students have historically shown weak scores in these areas.

Student Manuals are sent to students when they register to take the exam and they offer the student insights into the format and rationale behind exam questions. For example, the section on the verbal reasoning indicates that the intent is to test skills in four areas: Comprehension, Evaluation, Application, and Incorporation of New Information. Participants need to better appreciate that reading interventions which focus on evaluation, application, and the incorporation of new information items are more likely to achieve higher verbal reasoning scores.

Experience indicates that even after students at 'academic risk' read the MCAT Student Manual carefully, they will benefit further if someone proficient in all three skill areas interprets the significance of the information to them.

#5 Grantees should be encouraged to sponsor writing interventions that emphasize addressing the challenges that have been incorporated in the writing section of the MCAT (i.e. to define the given statement as thoroughly as possible, to explore the meaning of the statement by giving a contradictory example and to discuss ways to resolve the conflict between the initial statement and the contradictory example).

Process Guideline #5-A:
DDA should minimally earmark funds to support at least one Grantee in each region that has as its objective - improvement in the writing portion of the MCAT. This Grantee should additionally make a commitment to use collaborative learning approaches in conjunction with the basic writing skills exercises.

Cognitive Guideline #5-B:
Grantees should hire writing instructors who are skilled in helping students to strengthen their skills in the following areas: development of a central idea, synthesizing concepts and ideas, presenting their ideas in a cohesive and logical manner through accepted practices of grammar.

Cognitive Guideline #5-C:
Writing instructors should link basic writing skills development efforts with science content domains.

Process Guideline #5-D:
Grantees should institute mechanisms that will support participants continued writing skills development, over a 12 month or longer period.

Cognitive Guideline #5-E:
A possible scenario for ensuring a HCOP Fellow's writing skills continue to improve beyond their participation in a HCOP, would involve an individual functioning as a facilitator (once the HCOP is completed). The facilitator would establish a regular schedule for evaluating the student's progress and providing feedback, which would ideally be done every three to four months.

Rationale: AAMC and other research have shown students need guidance in addressing three tasks that are asked for in the MCAT essay question, e.g.: 1) definition of the given statement, 2) providing contradictory examples and,
3) discussing ways to resolve the conflict between the initial statement and the contradictory example.

The AAMC Study indicates that, on average, Writing Sample scores for repeat test-takers do not significantly increase within the time of 2 consecutive administrations of the test. The MCAT Validity Study coupled with pre and post writing scores obtained on MCAT Diagnostic Tests strongly suggest that one short-term (e.g. HCOP summer programs) intervention programs does not provide enough time to significantly increase students' Writing Sample scores on the MCAT. Interventions for the Writing Sample section of the MCAT should begin as early in the pre-med educational pathway as possible and should be reinforced for as many months as possible. Writing samples can be assigned and corrected by mail, HCOP Grantees could pay a writing instructor to provide follow-up. The Grantee could also include a detailed prescription for follow-up in the HCOP Fellow's exit report (noted in recommendation #7 and detailed in the Chapter) that could be used by student or the student's counselor to obtain appropriate follow up support.

#6 Grantees should be encouraged to implement activities in HCOP programs to cultivate non-cognitive skills, such as realistic self-appraisal and positive self concept.

Guideline #6-A:

Utilizing aspects of Collaborative Learning detailed in Chapter II, programs should be encouraged to target approaches to enhance both cognitive and non-cognitive skills.

Guideline #6-B:

Utilizing the Clearing House, Technical Assistance Conference (listed in recommendations under the Introduction) or other mechanisms, model programs and approaches for improving non-cognitive skills development should be communicated among HCOP Grantees.

Rationale: Outcalt, Rutala, et al (Academic Medicine 69 (1994): 577-582) have shown that although minority/disadvantaged students entered medical school with educational disadvantages and scored lower on "pencil and paper tests", their clinical performances on clerkships was equivalent to majority students. Roessler et al (Medical Education 53 (1978): 678 - 680) have also found that the addition of a "personality variable" to a cognitive criteria greatly enhanced the prediction of mean basic science grades and NBME scores. The staff of HCOP funded programs readily acknowledge the importance of non-cognitive variables, used in conjunction with cognitive variables, in predicting academic performance of minority/disadvantaged students.

#7 Establish a process by which HCOP program participants will leave the program with diagnostic results, specific information about the programs learning approaches, outcome performance and recommendations designed to enhance future development of cognitive skills.

Process Guideline #7-A:

Grantees should provide each HCOP Fellow with an "Exit Report" which, at a minimum, includes the results of cognitive and non-cognitive assessment tests, a statement about the specific interventions the student was exposed to, and, provides recommendations for follow up.

Rationale: The education literature supports the hypothesis that significant improvement in cognitive skills requires nurturing over time. HCOP programs can diagnose cognitive and non-cognitive weaknesses; and, can subsequently demonstrate how the weaknesses might be addressed over the life of the program. Subsequent development of these skills will ultimately require that the student practice the principles, strategies and techniques over time. Obviously, this phase of the skills development process can be greatly enhanced if this practice is monitored and/or facilitated, by an instructor or advisor. The HCOP Exit Report would provide the type of information needed to enable the provision of post HCOP program support.

CHAPTER III: SELECTION OF THE HCOP PARTICIPANT

#1 Encourage HCOP Grantees to utilize both cognitive and non-cognitive variables as a basis for the selection of HCOP participants and the matching of those participants to the programs which are most likely to benefit them.

Process Guideline #1-A:
Encourage HCOP Grantees to define and weight cognitive and non-cognitive variables in measuring the "relative academic risk" of the applicants within the context of their respective program characteristics.

Process Guideline #1-B:
HCOP Grantees could provide written justifications for their student selection strategy (identify and define why they choose each variable, determined its weight and ultimately, utilized the resultant indicators to select program participants).

Process Guideline #1-C:
With the support of a technical advisory committee comprised of educational specialists, statisticians, and selected others from HCOP funded programs, the Division of Disadvantaged Assistance could conceptualize, field test and validate, a model HCOP selection index. This index would provide cognitive and non-cognitive parameters for the admission of minority students into HCOP funded programs.

Rationale: The educational literature, particularly current research by Sedlacek & Prieto [Academic Medicine (1990) 65 (3): 161-166] and Carmen Webb, M.D. [Assistant Professor and Researcher for the Office of Medical education, Medical College of Pennsylvania and Hahnemann University], points to a tendency by health professions schools to over emphasize cognitive variables in the selection of students. However, the research being done by Sedlacek, Webb and others indicates that non-cognitives, appropriately weighted, and used in conjunction with cognitive variables, are useful predictors of minority/disadvantaged students relative risk of not succeeding in the health professions education process.

#2 Grantees should be encouraged to collect the "minimum data set" (discussed in Chapter IV) together with additional information from student applications, letters of recommendation, by telephone or personal interview and when possible by means of pre-admission cognitive and non-cognitive assessment tests.

Process Guideline #2-A:

Develop and provide all HCOP grantees with a Common Data Template (detailed in Chapter V) which would provide the programs with a guide on how and what, information to collect.

Process Guideline #2-B:

The 'Data Clearing House' (included in the recommendations listed under the Introduction) could provide technical assistance to programs in the analysis and/or utilization of this data for program design, student selection/program matching, as well as, project monitoring.

Rationale: Several medical schools have developed a computerized selection processes based on cognitive variables that have been weighted by means of regression analysis. Sedlacek is currently in the process of building a broad spectrum listing of non-cognitive variables (which are applicable to the health professions environment) and will ultimately test their validity. Some of the variables that will be used in a Grantees Selection Index will differ from those included by other Grantees; however, a number of variables will be common for all Grantees.

Meanwhile, studies performed on undergraduate (non-health professions) students indicate that cognitive variables tend to poor predictors of academic performance of most URM students. That same literature indicates that non-cognitive attributes such as realistic self-appraisal and positive self-concept coupled with cognitive variables are better predictors of academic performance than cognitive criteria (e.g. grade point average and standardized test scores) taken alone [Sedlacek & Prieto, Academic Medicine (1990) 65 (3): 161-166].

Use of a "minimum data set template" would establish a large bank of student cognitive and non-cognitive data that is consistent across programs. Grantees would still be left the option of adding HCOP-funded program or program-specific cognitive and non-cognitive data, beyond what is included on the template.

#3 While Grantees should be encouraged to use non-cognitive variables in conjunction with cognitive variables, they should be strongly cautioned on how best to apply this information within the emotionally charged context of the student selection process.

Non-Cognitive Guidelines #3-A:
Within the context of participant selection or denial, decision making which is subjectively based can be problematic. Without a generally accepted rule of measure for non-cognitives, Grantees should consider focusing on those variables that can be objectively monitored -- eg. attendance and punctuality.

Rationale: Until a non-cognitive testing mechanism can be developed and universally accepted, any non-cognitive variable which can not be objectively assessed and quantitatively measured, may be subject to challenges.

CHAPTER IV: ASSESSMENT OF HCOP PROJECT DATA

#1 Develop a common set of 'confidentiality' guidelines and encourage all Grantees to collect, analyze and disseminate student related data within the boundaries of these guidelines.

Process Guideline #1-A:
Obtain background material for the confidentiality guidelines from the Office of the Registrar of any academic institution and from organizations such as the Association of American Medical Colleges.

Rationale: The analysis presented in this report has underscored the importance of collecting student level data, that is comparable across programs. This is needed in order to better define which high risk students can best benefit from HCOP funded programs and to identify the approaches most likely to affect that improvement. Legal and ethical considerations demand the students sign an 'informed consent agreement' and that the data be kept confidential. The Secondary School Science Minority Achievement Registry (S^3MAR) serves as an excellent example of the process recommended in this report. The Registry lists student data emanating from questionnaires which were collected by the various program directors and forwarded to the AAMC for inclusion in the S^3MAR. The Directors also maintained informed consent signed by each student and his or her parent or guardian, on file.

#2 Encourage Grantees to collect cognitive and non-cognitive data utilizing a limited number of assessment instruments that have been field tested and shown to produce outcome data that is valid for minority/disadvantaged students.

Non-Cognitive Guideline #2-A:
The Division of Disadvantaged Assistance should devise a plan that limits the use of HCOP funds to the purchase of a limited number of field tested and validated non-cognitive diagnostic tests. A provision should be made that the data collected from such tests will be correlated with cognitive selection criteria and course performance indicators, to establish levels of academic risk (low., moderate, and high) for performance of minority students enrolled in health professions schools.

Non-Cognitive Guideline #2-B:
Grantees that conduct personal interviews or on-site screening of applicants prior to acceptance should be encouraged to require this select group of applicants to take one or more of the DDA approved non-cognitive assessment tests. This should assist in the personalization of the course and in efforts to match students for collaborative interactions.

Non-Cognitive Guideline #2-C:
Grantees which do not come into personal contact with participants until after they have matriculated into their programs should require each participant to take one or more non-cognitive assessment tests before beginning the program.

Cognitive Guideline #2-D:
The Division of Disadvantaged Assistance should devise a plan that will allow HCOP grantees to purchase a limited number of field tested and validated cognitive diagnostic tests. A provision should be made that the data collected from such tests will be correlated with HCOP defined cognitive selection criteria and course performance to establish levels of academic risk (low.,moderate, and high) for performance of minority students enrolled in health professions schools.

Cognitive Guideline #2-E:
The source of 'key' data variables such as grade point averages, MCAT scores, DAT scores, etc., should also be notated, when writing proposals or progress reports.

Cognitive Guideline #2-F:
Grantees should report the MCAT sub-test scores of medical school applicants or medical students; and, indicate whether the MCAT sub-test scores are AMCAS validated, student self-reported, or transcript validated. **In those instances where AMCAS validation is not made, Grantees should use the** Minority Med-Mar Registry to check student reported sub-test scores.

Process Guideline #2-G:
The Data Clearing House could serve as mechanism for the distribution of cognitive and non-cognitive assessment tests and could provide technical assistance in their implementation and the utilization of the data collected.

Rationale: There is an urgent need to design a process that yields a "minimum common data set" that cuts across the many programs that are funded by HCOP. Pooled data will have the potential to finally yield statistically valid outcomes, an objective which is currently difficult for any one HCOP funded program to effect alone because of the relatively small number of students that participate in each program. Additionally, data tests which have been validated are more likely to yield information of worth to the individual programs for application within their design, applicant selection and impact monitoring efforts.

#3 Encourage Grantees to reflect the components of a "minimum data set" in the questions they include on their participant applications.

Process Guideline #3-A:
Develop and provide all HCOP grantees with a Common Data Template (in Word Perfect) on a 3.5/5.25 floppy disk and encourage all programs to utilize it. This template will serve as a guide for the collection, maintenance and communication of minimum data requirements.

Rationale: Reviews of HCOP Progress Reports and the efforts of the HCOP Work Group to provide 5 year priori and one year current applicant data indicate that one of the most significant sources of foundational student data, is the participant application. All Grantees currently collect this data, in varying degrees and extent, however, few surveyed effectively used a consistent, broad spectrum of this information to track and access program effectiveness.

# 4 Establish a HCOP Fellows Program that identifies the type of HCOP program; and also indicates how many different HCOP programs the a student has participated in. The encourage Grantees to use this information to enhance their ability to track and subsequently report on the academic progress of former participants as they progress through the health profession schools.

Process Guideline #4-A:
A consistent process can be instituted where Grantees identify participants in HCOP funded programs, of 4 weeks or longer, as "HCOP Fellows."
The following is an example of how such designation could be made: HCOP Fellow-Level One = Rising high school seniors and rising college freshmen. HCOP Fellow-Level Two = Rising college sophomore students. HCOP Fellow-

Level Three = Rising college junior students. HCOP Fellow-Level Four = Rising college senior students. HCOP Fellow-Level Five = Post graduate summer program participant. HCOP Fellow-Level Six = Post graduate academic year program.

Process Guideline #4-B:

Encourage Grantees to provide each HCOP Fellow with an "Exit Report" that minimally includes a description of the cognitive and non-cognitive assessment results, the outcome performance related to program interventions and the recommendations for follow up.

Process Guideline #4-C:

Encourage HCOP Fellows to sign a release which allows HCOP projects to follow the Fellow's scores and GPA throughout the student's health profession educational process.

Process Guideline #4-D:

Develop a commitment form and have it signed by all HCOP Fellows who elect to do so. This form should request that HCOP Fellows report their educational progress back to their sponsoring HCOP project.

Rationale: A "HCOP Fellows Program" would enhance student tracking efforts, engender a greater sense of pride within student participants and give the national HCOP program greater visibility. By providing each HCOP Fellow with a written exit record that describes the cognitive and non-cognitive profile of the HCOP Fellow at the time of entry into the program, including details on the type of learning experiences and how the student performed in each experience, a solid blueprint for the student's continued growth is created.

Additionally, the formal designation of participants as HCOP Fellows, together with the signing of commitment statement forms, will empower the student participants as full partners in the HCOP program, enhance student self-esteem (e.g. MARC Fellows), arm students with specific insights about their academic strengths and weaknesses status and generate an
"esprit de corps" which will enhance recruitment efforts.

On example of an application of "HCOP Fellows" is in conjunction with six week summer residential programs like the Drew Summer MCAT program and the SOAR program would be ideal for Level One and Level Two HCOP Fellows. They have been effective starters of the formal cultivation of conceptual, problem solving and reasoning skills. Once skills development has been initiated, both programs have developed procedures by which HCOP Fellows would be able to continue the skills nurturing process within the context of their college experience.

#5 Encourage Grantees to participate in a national program designed to better track the academic performance and the ultimate career path of former HCOP student participants.

Process Guideline #5-A:
Grantees should use the program-specific cognitive data, together with their non-cognitive data (using HCOP-approved tools), as a consistent basis for monitoring and assessing program effectiveness.

Process Guideline #5-B:
The information described in Guideline #5-A should be transmitted, via the "minimum data set template, (elaborated on in Chapter IV)" to a central processing point, such as the Data Clearing House (as identified in the Introduction)

Rationale: This is needed to ensure the availability of quality comparable data which can be used to accurately assess HCOP's impact both locally and nationwide, and, to identify truly effective models.

#6 Grantees should be encouraged to track the academic performance of past participants and relate academic outcomes to the non-cognitive attributes defined while a participant in the program.

Process Guideline #6-A:
The first step of this effort is to heighten HCOP name recognition in conjunction with program efforts. By noting HCOP's involvement clearly within the title or funding sources (as noted in the global recommendations included under the Introduction) this tracking will be facilitated.

Process Guideline #6-B:
By providing students with exit reports or report cards (as detailed in the Introduction and Chapter II) which describe the skills development interventions in which they participated and what is needed to continue developing these skills, a continuum will be initiated which allows for improved tracking beyond HCOP participation.

Process Guideline #6-C:
Through enhancement of the HCOP image by designating participants as "HCOP Fellows" (detailed in Chapter IV), students are 'empowered' to be at least partially responsible for the reporting of their own progress. Coupled with the elective signing of academic performance reporting release forms, the stream of student-specific data is likely to be greatly enhanced.

Rationale: The research indicated that longitudinal tracking of students who have participated in HCOP programs is very limited. The community based programs are most limited in their ability to track the academic progress of former participants because few have formal linkages to academic institutions to which their former students matriculate. HCOP programs sponsored by academic institutions generally are able to track the academic progress of former participants if the participants matriculate into academic programs at the same institution. However, these programs also have difficulty in obtaining data if the former participants matriculant into other institutions. Therefore, the quality and quantity of tracking data can be greatly enhanced if former HCOP participants take greater responsibility in reporting their academic progress back to the sponsoring HCOP program. This process can be encouraged by empowering the participant as a HCOP Fellow.

APPENDICES

Appendix #01
HCOP WORK GROUP MEMBERSHIP

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HCOP WORK GROUP (HWG)
MEETING SUMMARY

Between June 3 and 4 of 1993, a group of twelve representatives from broad spectrum university programs met in Washington, D.C. for an intense two-day working session. Each of these individuals represented research and programming efforts which had long standing association with the Health Careers Opportunity Program (HCOP).

The goal of this meeting was to provide the ongoing HCOP research effort with technical input in the following areas:

I. The development and testing of **Selection Criteria** for determining characteristics of minority students at educational levels from high school seniors to health professional school enrolles who are most likely to improve their potential to become health care professionals by participating in Federal educational support programs such as the Health Careers Opportunity Program (HCOP).

II. The development of a **Methodology for Analyzing the Effectiveness of Specific HCOP Project Interventions** approaches to improving the problem-solving, reading conceptualization, communication, and test-taking skills of the students that they serve.

The lively two-day work group session produced many significant contributions to the research effort and induced extensive discussions around the key areas which would provide a foundation for the report. The following short summaries highlight some insights presented at the meeting.

I. Selection Criteria

For the purpose of the discussion, the HWG participants were asked to focus on the following phrase of Task 7 of the research contract: *"improve their [minority/disadvantaged students] potential to become health care professionals by participating in Federal support programs such as the Health Careers Opportunity Program".*

The HWG pointed out that health professions schools tend to be at the end of the educational pathway, while most HCOP programs fall earlier along this pathway. It was the participants' view that HCOP programs might consider placing some weight on non-cognitive criteria in conjunction with traditional cognitive criteria such as grade point averages or standardized test scores.

For example, the HWG members felt that medical schools placed an excessive emphasis on MCAT scores when considering the applications of under-represented minority (URM) students. They expressed the view that medical school admissions committees did not adequately take into account a number of factors that may influence the successful medical school course and USMLE performance by URM students with modest MCAT scores. Much of the discussion centered around the individual program experiences of the Work Group members who provided the following observations:

- many URM students successfully complete HCOP-funded, post baccalaureate programs with "A"s and "B"s in all courses in spite of modest-to-low MCAT scores; and,

- URM post baccalaureate students, who had received modest-to-low MCAT scores, gain acceptance to medical school and usually pass all medical basic science courses and Step 1 of USMLE.

Given these programmatic observations, the Work Group emphasized the need to communicate to HCOP programs the necessity of integrating non-cognitive skills development in conjunction with cognitive skills development of the students that they serve. The discussion was enhanced by the interjection of supportive findings from the research on non-cognitive attributes carried out by Dr. William Sedlacek, and insights gained from the Association of American Medical Colleges' MCAT Validity studies -- these and other findings are detailed more extensively in the body of the final report.

The discussion on selection criteria continued beyond the directive of Task 7. The HWG emphasized that HCOP approaches (both non-cognitive and cognitive skills development) alone will not be enough to reach the goal of increased numbers of minority/disadvantaged students being accepted into, and successfully graduating from, health professions schools. Unless the admissions committees of health professions schools are willing to additionally consider the skills development (both cognitive and non-cognitive) advanced by the applicant's participation in HCOP and HCOP-like programs, significant increases in the number of URM students accepted into these programs will not occur, at least in the near future.

II. Analytical Methodologies:

The HCOP Work Group (HWG) was unanimous in the opinion that before they could approach a discussion on the identification of effective methodologies for measuring the impact of a HCOP intervention, there needed to be a greater commonality of understanding of what the inputs to this process were. This lead them to the initial step of outlining the key questions which must be answered before appropriate methodologies could be agreed upon. Some of the more far-reaching of these questions include:

- How does one measure the impact of any one intervention?

- Should the HCOP program itself be viewed as an intervention?

- Considering that many HCOP programs do not ask students about previous participation in a HCOP-funded activity, is it possible that the impact of subsequent HCOP interventions could be inflated?

From the discussion of these and other questions, it was obvious to the Work Group members that they would need the quantitative and qualitative data to answer the questions they had posed, and to develop appropriate methodologies.

The HCOP work group (HWG) members recommended that the first, and perhaps most important step, was to perform a preliminary evaluation by gathering data from the programs represented by the members of the group. It was agreed that the data would cover the last five years of each program's operations. As part of this preliminary effort, the group also recommended that each program administer one or more of the following diagnostic tests at the start of the 1994 summer program cycle:

- the Learning and Study Skills Inventory (LASSI) test
- Sedlacek's Non-Cognitive Questionnaire
- the Achievement Diagnostic Assessment Test

These diagnostic tests were selected because they had been field tested and validated as being appropriate testing instruments for minority/disadvantaged student populations.

HWG Concluding Statements

"The Work Group believes that the length of the meeting was insufficient to adequately address the important issues that surfaced during discussions related to the assigned tasks. The group recommends that members of this Work Group be reconvened in the near future to continue this process. It also recommends that this Work Group be expanded to represent a broader cross-section of HCOP program types. It further recommends, as a result of its deliberation, that HCOP view this charge as a top priority of the agency, and as an ongoing process. In concert with this view, the group members will commit themselves to further assist in developing appropriate guidelines as defined in Task 7. The Work Group members will also commit themselves to assist in a preliminary evaluation exercise. Each member of the group with readily retrievable data will compile that data and forward it to the contract staff for preliminary evaluation. It is agreed that the data should cover the last five years of each program."

Appendix #02

Profile of the Minority Applicant Pool for American Medical Schools[1]

National data indicate that a significant portion of educationally and economically disadvantaged students, many of whom happen to be minorities, continue to test lower on average than do most majority students. For example, Whitten's research shows that mean MCAT scores of African American medical school applicants decreased overall for the period 1978-1990, and were less competitive than those of the majority students.

The following highlights from Whitten's research illustrates the concern over the quantity and quality of African American applicants to medical school:

Between 1978 and 1990, there was an overall decrease in the number of African American applicants. During that period, there was also a cumulative decrease in the grade point average, the biology MCAT score, and the chemistry MCAT score of the African American applicant pool.

AFRICAN AMERICAN APPLICANTS					
		<2.76 GPA	BIOL 1-8	MCAT CHEM 1-8	QUANT. 1-8
	NO.	%	%	%	%
1978	2,564	53	88	88	89
1981	2,644	53	82	85	91
1985	2,428	57	76	84	92
1989	2,200	43	75	83	89
1990	2,355	42	75	83	91

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[1] Whitten, Charles F. (1991). Proceedings of the First National Postbaccalaureate Programs Conference.

Equally important, between 1981 and 1990, there was not a significant change in the number of African American matriculants. During this same period, there was an overall decrease in the biology and chemistry MCAT scores of African American matriculants.

AFRICAN AMERICAN MATRICULANTS					
		<2.76 GPA	BOIL. 1-8	MCAT CHEM 1-8	QUANT. 1-8
	NO.	%	%	%	%
1978	938	30	80	80	88
1981	1,001	29	73	75	88
1985	923	27	62	73	88
1990	1,055	29	62	75	89

Whitten's research (1978-1990) concludes that the pool size as well as quality of African American applicants to medical school is not improving.

It should be noted that a more recent study, the 1995 Three Year Progress Report on Project 3000 by 2000, concludes that "...URM matriculants have increased by 37% since 1990, ... [and that the project is] nearly on target for reaching...the goal of 3000 URM matriculants by the year 2000." The Progress Report additional states that "it is likely that the growth in minority science bachelor's degree recipients, and minority medical school applicants, in part, results from the increased popularity of medicine as a career choice of students from all racial and ethnic backgrounds."[2]

While the positive trends in the number of URM applicants and matriculants is very encouraging, the HWG expressed caution that the popularity of medicine as a career choice may relate to current employment trends ie. market reductions in white collar job opportunities. In addition, the HWG expressed concern that the increase in minority matriculants may be adversely affected by the current legal and political climate regarding affirmative action policies. Lastly, the 1992 AAMC TRENDS report shows that biology and reading MCAT sub-test scores increased (from 7.37 to 7.71, and, 6.63 to 6.81 respectively) for African American matriculants; however, because the comparative scores for majority matriculants remained at 9.79 and 8.43 respectively, the increases may not be sufficient to maintain or improve the ratio of African Americans who successfully matriculate into and graduate from medical schools.[3] Given this background, the HWG reaffirmed the strong need to continue Federal Support Programs such as HCOP and PostBaccalaureate Programs.

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[2] Progress 3000 by 2000, Year Three progress Report (1995). Association of American Medical Colleges. Washington, DC.

[3] Trends in Medical School Applicants & Matriculants. (1992) Association of American Medical Colleges, Washington, DC, pp IV-VII.

Appendix #03

Measuring Gains in Cognitive Skills Development

Assessing the effectiveness of a given HCOP approach in improving the cognitive skills of minority/disadvantaged students is a complex challenge. The complexity of this process is accentuated by the fact that, taken as a group, HCOP programs employ a broad spectrum of educational and learning approaches. As a result, in order that an assessment can be made of gains in any particular are, for example -- problem solving -- analysis must follow an intricate process.

This process has been effectively diagrammed in Champagne's[1] Taxonomies of Cognitive Skills, Thinking Processes, and Academic/Assessment Exercises (see attached). As the diagram demonstrates, it is an extremely difficult process to predict the impact of short term interventions on long term cognitive skills development.

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[1] Champagne, Audrey. (1992). Cognitive Research on Thinking in Academic Science and Mathematics in (Halpern, Diane ed.) Enhancing Thinking Skills in the Sciences and Mathematics. Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Appendix #04

A Selection Index Utilized by the Admissions Committee of a Nationally Recognized Medical School

Most institutions of higher education use some type of "indexing" in the selection of their respective students. However, the majority of institutions do not have "rigid" indices based on statistically valid formulae. It is often the case that admission committees of these institutions make acceptance and rejection decisions, particularly those involving under represented minority (URM) students, on the basis of "generally understood cognitive and non-cognitive cut-off variables." For example, it is frequently the case that admissions committees reject any student with a MCAT sub-test score of 4 or less, and/or any student who had a grade point average of less than 2.30.

This appendix provides an overview of the factors that are currently used by a nationally recognized medical school to calculate a Selection Index for applicants (both majority and minority students) to its College of Medicine. It should be noted that the Selection Index consists of a Cognitive Index and a Non-Cognitive 'Diversity' Index.

It is also important to point out that use of the selection index has:

- increased faculty confidence in the decision-making of the admissions committee; which in turn, buttressed faculty support for continued minority student admissions; and,
- enabled the admissions committee to select URM students with modest academic profiles who were at moderate-to-low risk of not completing their medical education.

COGNITIVE INDEX (CI)

A regression equation was developed by the institution to yield a numerical score based on the following cognitive data: cumulative grade point average, college competitiveness, and MCAT scores. Statistically weights were applied to one or more of the equation's variables as warranted by the institution. The medical school utilizes the following cognitive index equation:

$CI = 14.77 + (.72 \times WGPA) + (2.52 \times MCAT\ average)$

WGPA = cumulative GPA (CGPA)[2] x college weight

College weights range from 7.70 to 10.56

All schools with weight below 7.70 would receive 7.70 weight

All schools with weight above 7.70 would receive their actual weight

MCAT average = Average of 3 MCAT scores

EXAMPLE

Method of computing the Cognitive Index:

> Applicant has a premedical college grade point average (GPA) of 4.5 and is attending a college with a weight (WT) of 9.2.
>
> Applicant's MCAT average is 10.
>
> $$CI = 14.77 + [.72 \times (\underset{\text{GPA x WT}}{4.5 \times 9.2})] + 2.52 \times \underset{\text{MCAT AVG}}{10}) = 69.78$$

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[2] All GPA's are converted to the College of Medicine's 5 point grading scale, where 5.0=A, 4.0=B, 3.0=C, 2.0=D, and 1.0=E (failing).

NON-COGNITIVE DIVERSITY INDEX (DI)

Similarly, the university developed an equation for the Non-Cognitive Diversity Index. The numerical score is added to the cognitive index score. Factors contributing to the equation for the diversity index include the following:

I. Minority Status

Cuban
Hispanic of Pan American Origin
Mexican American
American Indian/Alaskan Native
Black American
Mainland Puerto Rican

II. Disadvantaged Status

Examples of students with a disadvantage include, but are not limited to the following:

a) Those who maintained a part-time or full-time job during college out of necessity to support family or otherwise.
b) Those whose parents are less educated (e.g., do not have a high school diploma or have less than a high school education.)
c) Those individuals who have suffered from prolonged illness, injury or extreme stress that has interfered with their academic performance.
d) Those individuals who have a physical or mental disability.
e) Those individuals who have a background in a rural or underserved region of the state.

III. Special Achievements

a) Academic Category

1. Advanced degrees (e.g., Ph.D., etc.)
2. Noteworthy publications (maximum of 2 points - one for publication while an undergraduate; one for publications at the discretion of the Screener)
3. Rigorous academic program
4. Honors programs or honors courses where warranted
5. Other noteworthy achievements - 1 year + participation

b) Non-Academic Category

Diversity index points may be awarded for the following activities providing the length of participation totals one year or more in each area: long-standing achievement, leadership in campus or community activities, volunteer work, volunteer undergraduate research, music, theater and those who served for the United States on active military duty.

In response to the need for primary care physicians and to recognize other medical needs in the community, discretionary Diversity Index points may be awarded to show preference for characteristics not defined elsewhere in the guidelines which would further enhance the diversity of the class. The Screeners may award up to 2 discretionary Diversity Index points for activities, providing the applicant's participation time totalled 1 year or more. The award of such discretionary points must be documented, justified by the Screener and approved by a two-thirds majority vote of the Screeners Subcommittee.

SCREENERS PROCEDURES FOR ENTERING CLASS

Candidates who are offered a place in the class must present credentials at least equal to the Cognitive Index (CI) + Diversity Index (DI) [Selection Index (SI) = CI + DI] listed under Screeners Guidelines. The CI + DI was selected on the basis of a statistical analysis of the credentials earned by the class entering in the previous year's admission cycle. The Admissions Committee will reach one of the three final decisions for all candidates.

ADMIT	The candidate will be offered a place in the class entering.
ALTERNATE	The candidate will be selected for alternate status and given a specific alternate ranking to be determined at the conclusion of the review process.
DENY	The candidate's application has been reviewed and is not competitive with candidates who will be offered a place in the class.

SCREENERS GUIDELINES

Minimum cumulative GPA for consideration: 3.30

Minimum 1991 MCAT numerical average for consideration: 5.33

Minimum old MCAT numerical average for consideration: 5.83

Minimum old MCAT Writing Sample Score for consideration: J

Minimum SI for consideration: 69

Decision Recommendations by Selection Index Score [Combined CI and DI]:

RESIDENT

Deny	50.00 - 62.99
Alternate	63.00 - 69.49
Admit	69.50 or greater

NON-RESIDENT

Deny	53.00 - 72.99
Alternate	73.00 - 76.99
Admit	77.00 or greater

Appendix #05

The Health Careers Opportunity Program (HCOP)/Special Health Careers Opportunity Grant Program (SHCOG)

Begun in 1972 as the Special Health Career Opportunity Grant (SHCOG) Program, a Federal initiative known today as the Health Careers Opportunity Program, (HCOP) was authorized by Title VII, Section 787 of the Public Health Service Act, as amended by Public Law 100-607. The current authorizing legislation for the HCOP is Section 740 of the Act, as amended by the Health Education Extension Amendments of 1992. The purpose of the HCOP is to address the underrepresentation of minority and disadvantaged individuals in the health and allied health fields -- Allopathic and Osteopathic Medicine, Dentistry, Optometry, Pharmacy, Public Health, Health Administration, Clinical Psychology, Chiropractic, Podiatric and Veterinary Medicine, graduate programs in psychology and a variety of allied health professions. Experience has demonstrated that, upon completion of their study, HCOP graduates are most likely to provide clinical and other health services to underserved rural and urban populations.

There are five legislative purposes for the Health Careers Opportunity Program[3]:

- Recruitment - Activities designed to identify, recruit, and select individuals from disadvantaged backgrounds for education in the health or allied health professions. For example, motivational activities, distribution of information, exposure to role models, and counselling.

- Preliminary Education - Preprofessional education designed to expand the academic ability and otherwise prepare student participants from disadvantaged backgrounds during their preprofessional training that they may subsequently complete the regular course of education in a health professions school or school of allied health. Such education must be offered prior to entry in a health professions or allied health professions school and may not include courses already taught as part of the regular course of education to a degree.

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[3] 1994 HCOP Technical Assistance Manual. Division of Disadvantaged Assistance. Rockville, Maryland.

- Facilitating Entry - Activities designed to enhance the competitiveness of student participants from disadvantaged backgrounds for admission to health professions schools or schools of allied health, such as improving performance on admissions tests, counselling concerning the application process, and assisting admissions committees in the evaluation of disadvantaged applicants.

- Retention - Activities designed to help student participants form disadvantaged backgrounds, who have been accepted to or are enrolled in health professions schools or schools of allied health, to complete their education. Such activities may include tutorial assistance, counselling, and assistance in adjusting to the environment of the school. Activities may not include courses already taught as part of the schools curriculum.

- Financial Aid Information Dissemination - Activities involved in the distribution of information to student participants from disadvantaged backgrounds about financial aid available in the health professions schools, schools of allied health, or schools and entities which provide training necessary to qualify for enrollment in health professions schools or schools of allied health.

Appendix #06

Aggregate Data Supporting the Success of HCOP-funded PostBaccalaureate Programs

The postbaccalaureate programs highlighted in this appendix have utilized aggregate data to strongly suggest that their programs were directly responsible for hundreds of underrepresented minority (URM) students gaining acceptance to and subsequently graduating from medical schools over the past 2 decades. This data is very useful in providing an overview of the successful outcomes of the program.

Post-Baccalaureate Program at Creighton University

- 1975-1989 (14 Years)
- 275 Students Completed the Program
- 230 Students Accepted by a Medical or Dental School
- Acceptance Rate: 84%
- 214 Students Graduated or Are Still in Medical or Dental School
- 93% or 230 Students

Post-Baccalaureate Program at Wayne State University

- 1970-1990 (20 Years)
- 153 Students Completed the Program
- 132 Students Accepted by a Medical School
- Acceptance Rate: 87%
- 110 Students Graduated or Are Still in Medical School
- 83% or 132 Students

Post-Baccalaureate Program at Georgetown University

- 1977-1993 (16 Years)
- 260 Students Complete the Program
- 226 Students Accepted by Medical School
- Acceptance Rate: 90%
- 204 Students Graduated or Are Still in Medical School
- 90% or 204 Students of 226 accepted

Appendix #07

The Utilization of Cohort Data to Predict Program Outcomes

Several HCOP funded programs have been able to generate generally enlightening information about their respective applicant and participant pools by using cohort data.

The data highlighted in this appendix strongly suggests that if preadmission variables such as grade point average and standardized test scores are similar for two subgroups (cohorts), the grantee may explore other preadmission variables that may correlate to performance in an academic year course.

The data for each cohort follow on pages 104 and 105 respectively.

Cohort #1 consists of students who participated in a HCOP or HCOP-like Program, or students who had taken a post-graduate Biochemistry course.

Cohort #2 consist of students who did not participate in any structured HCOP or HCOP-like academic enrichment program during or after college.

With the exception of the Science GPA, Cohort #1 has a lower average for the Total GPA, MCAT scores, and College Rating columns than Cohort #2. Thus, one might expect Cohort #2 to perform at an academic level greater than or equal to Cohort #1.

The variable which seems to differentiate the two cohorts is -- '**participation in a HCOP academic enrichment program**' or previous intervention. This variable may explain why Cohort #1 performed better in the medical physiology course work than Cohort #2.

(the cohort is listed in descending order of Science GPA)

INTERVENTION COHORT #1

SCI GPA	TOTAL GPA	MCAT SCORES				TOTAL MCAT	COLLEGE RATING	PRE & POST BACCALAUREATE INTERVENTION	PHYSIOLOGY FINAL GRADE♥
		VR	PS	WS	BS				
3.12	2.84	3	5	N	8	16	2	1 Year	72.9%-P
2.88	3.13	7*	6.5*	-	6.5*	20*	2	1 Year	62.8%-P
2.83	2.86	8	6	N	5	19	3	6 Weeks	72.4%-P
2.81	2.58	5.5*	4.5*	-	4.5*	15*	2	6 Weeks x 3	78.3%-P
2.59	2.63	8	5	P	7	20	3	1 Year	64.5%-P
2.29	2.50	6	7	O	4	17	2	1 Year	76.0%-P
2.28	2.66	6	5	O	5	16	5	1 Year	83.6%-P
2.05	2.44	13	6	O	5	24	4	6 Week	62.2%-P
2.04	2.25	5*	5*	-	5*	15*	2	1 Year	74.2%-P
2.54	*2.65*	*7*	*6*	*6*	*6*	*18*	*3*		*71.9%*

(averages for each column)

Legend

* - CONVERSION OF OLD MCAT SCORES TO NEW MCAT APPROXIMATION (NEW TOTAL = 1/2 OLD TOTAL)
OLD (READ+QUANT)/2 = NEW VRS AND (OLD BIO + CHEM)/2 = PS ALSO = BS
♥ - COURSE AVERAGE = 74.0%

(the cohort is listed in descending order of Science GPA)

NON-INTERVENTION COHORT #2

SCI GPA	TOTAL GPA	MCAT SCORES				TOTAL MCAT	COLLEGE RATING	PRE & POST BACCALAUREATE INTERVENTION	PHYSIO-LOGY FINAL GRADE♥
		V R	P S	W S	B S				
3.11	3.20	6	7	N	6	19	5	NONE	77.4%-P
3.01	2.88	4	7	O	5	16	2	NONE	73.1%-P
2.86	2.99	6	5	N	5	16	2	NONE	54.1%-P
2.55	2.80	5	5	O	6	16	5	NONE	69.1%-P
2.51	2.78	8	7	N	5	20	4	NONE	79.8%-P
2.48	2.94	8	5	N	5	18	5	NONE	53.1%-P
2.45	2.72	9	8	O	6	23	5	NONE	77.7%-P
2.45	2.92	6	6	O	8	20	5	NONE	71.1%-P
2.24	2.77	6	5	O	5	16	2	NONE	55.1%-P
2.23	2.54	6	8	O	7	21	3	NONE	74.2%-P
2.15	2.53	7	6	O	6	19	5	NONE	58.6%-P
1.93	2.31	8	8	O	6	22	5	NONE	60.4%-P
1.84	2.25	9	7	O	8	24	4	NONE	68.4%-P
2.45	*2.70*	*7*	*7*	*5*	*6*	*19*	*4*		*67.0%*

(averages for each column)

Legend

* - CONVERSION OF OLD MCAT SCORES TO NEW MCAT APPROXIMATION (NEW TOTAL = 1/2 OLD TOTAL)
OLD (READ+QUANT)/2 = NEW VRS AND (OLD BIO + CHEM)/2 = PS ALSO = BS

♥ - AVE. = 74.0%

Appendix #08

Regression Analysis on Student Specific Data to Predict Medical School Course Grades

This appendix illustrates how one grantee applied the statistical procedure of regression analysis to student specific data to predict course grades in medical physiology, biochemistry and embryology.

Hypothesis

Given the cognitive profiles of students considered to have "high academic risk", does participation in a HCOP or HCOP-like enrichment experience positively correlate with competitive performance in difficult medical school courses?

Description of Cohorts

Cohort No. 1:

Students who either participated in a HCOP or HCOP-like program or completed a post-graduate course e.g. biochemistry.

Cohort No. 2:

Students who did not participate in any structured HCOP or HCOP-like academic enrichment program during college or after college.

Design

Criterion - freshman medical physiology, biochemistry, and embryology final course grades.

Predictor - Number of weeks of HCOP or HCOP-like academic intervention support.

Rationale

Correlation coefficients established in several studies indicate relatively strong associations between Science UGPA, MCAT Subtest Scores (particularly the Physical and Biological Sciences) and medical school first-year grades in physiology, biochemistry, and embryology.[4] [5] [6] [7]

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[4] McGuire, F.L. "The New MCAT and Medical Student Performance". Journal of Medical Education. Vol 55, 1980.

This analysis will determine if participation in a HCOP or HCOP-like experience significantly improves the correlation coefficients for academic performance in medical school physiology, biochemistry, and embryology.

Description of Regression Equations

The data from two cohorts of students were analyzed by means of three regression equations. These equations were constructed using multiple regression procedures for science content domains.

The physiology course grade was designated criterion 1. The biochemistry course grade was designated criterion 2. The embryology course grade was designated criterion 3.

Participation in a HCOP or HCOP-like Program was used as a predictor for academic performance in criterions 1 - 3.

Results

The "HCOP Enrichment" positively predicted the Physiology, Biochemistry, and Embryology course grades for both cohorts of students.

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[5] Association of American Medical Colleges. (1994). MCAT Validity Study. Washington, DC.

[6] Anderson, J. and Mitchell, K. (1986). Preadmission Data and Medical Performance for Black Medical Students, from paper presented at AAMC conference.

[7] Hall, Michael and Stocks, Michael. (1995). Relationship between Quantity of Undergraduate Science Preparation and Preclinical Performance in Medical School. Academic Medicine. Vol 20 (3).

Appendix 09
Customized Counselling Utilizing Student Specific Data

Some grantees have used student-specific data to customize skills development strategies, to establish program specific selection criteria and to link intervention approaches (and components of these approaches) to student participation in the HCOP projects. This appendix illustrates the use of student level data in providing an academic profile of each of the students participating in a HCOP funded program. The detailed information offers HCOP staff an opportunity to "customize" student specific counselling and to subsequently relate the many data variables to academic performance at some later date. The table below also underscores the appropriate precautions (eg. the use of a code in lieu of the student's name or SS#) to be taken with student-specific data.

Participant Data Related to the Physical Sciences																		
Entering						Chemistry							PHYSICS					
Code	GPA	AO	BCPM	BCPM Hours	Major	Hrs	GPA	Hrs/ Grades In-organic	Hrs/ Grades Organic	Needs Prereq	Needs Repeat	Mcat Prep	Hrs	GPA	Grades	Needs Prereq	Needs Repeat	MCAT Prep
A1	2.63	2.96	2.36	40	Biology	12	1.90	4/C,4/D	4/C	Y	N	Y	0			Y	N	Y
A2	3.46	3.06	3.25	35	Zoology	18	3.06	4/A,3/C, 1/A,3/A	4/C,4/C	Y	N	Y	0			Y	N	Y
A3	2.90	3.06	2.37	64	Biology	18	2.98	5/C,5/C	3/B,3/C, 2/A	N	N	Y	8	2.0	4/C,4/C	N	N	Y
B1	3.00	3.27	2.83	24	Physiology	0	3.00	4/B		Y	N	Y	0			Y	N	Y
B2	3.06	3.38	2.37	87	Biology	18	3.25	4/B,4/B	4/A,4/B	N	N	Y	10	3.50	4/A,1/A, 4/B,1/B	N	N	Y
C1	2.90	3.06	2.06	91	Zoology	27	1.97	5/D,5/D, 5/B	3/C,2/B, 3/B,3/B	N	N	Y	8	3.50	4/B,4/B	N	N	Y
C2	2.63	2.96	2.24	40	Philosophy	16	2.63	4/C,4/B	4/C,4/D	N	Y	Y	8	2.00	4/C,4/C	N	N	Y
C3	3.00	3.77	3.28	87	Biology	20	3.06	4/B,4/B	4/A,4/A, 3/B	N	N	Y	8	3.00	4/C,4/A	N	N	Y

Appendix #10

Program Outcomes For Xavier University

The Pharmacy Pre-Matriculation Program includes traditional classroom assignments with strong emphasis on vocabulary and reading skills as well as small group based problem-solving exercises to develop independent thought and enhance independent learning.

The program has produced statistically significant data of the students' success in academic year pharmacy courses following participation in the pre-matriculation program. For example, between 1990 and 1991, an average of 92 % of the participants passed the pharmacy school's academic year pharmacy calculation and medicinal chemistry courses.

Year	No. in Program	Pharmacy Calculation		Medicinal Chemistry	
		% Pass	% Fail	%Pass	%Fail
1990	21	90%	10%	86%	14%
1991	43	94%	6%	98%	2%

Appendix #11

National Program Outcomes for the Supplemental Instruction (SI) Program

Academic achievement for students of differing previous academic achievement.

Data were analyzed to determine the utilization and effectiveness of SI services for students of differing previous academic achievement. Previous academic achievement was defined by high school (percentile) rank and mean composite score on a college entrance exam (e.g., American College Testing service). Students were divided into quartiles on the basis of their mean composite ACT score as compared with other UMKC students. These data warrant the following observations:

- Students in the bottom quartile group used SI services at nearly the same rate as did students in the top quartile.
- Despite quartile ranking, SI-participating student earned significantly higher grades than their non-participating counterparts.
- SI-participating students in the bottom quartile and the middle two quartiles reenrolled at the institution at significantly higher rates than their non-participating counterparts.
- While the SI and Non-SI groups of the top quartile reenrolled at 93 percent, the Top Quartile SI-participants received a significantly higher mean final course grade.

It is noteworthy that SI services appear to meet the needs of students with a wide range of previous levels of academic achievement within the same group setting, thus reducing the necessity for the institution to provide additional and separate tutorial programs.

Academic achievement of African-American students.

Table 1 describes the academic performance of all 110 African-American students enrolled in 12 UMKC College of Arts and Science, School of Pharmacy and School of Basic Life Science courses that had SI attached during the 1987 Fall Semester. The data suggests that African-American students using SI when compared with Non-SI students of the same ethnicity had a significantly lower percentage of D and F final course grades and course withdrawals, and earned a significantly higher mean final course grade.

Table 1

Effectiveness of SI With UMKC African-American Students: Fall 1987 (N=110)

Group Composition	Number/Percentage of Students	Percent D, F, or W	Mean Final Course Grade
SI-Participant	39,35.5%	31%*	2.2**
Non-SI Participant	71,64.5%	46%*	1.8**

*Level of significance of difference:0.05 using chi square test.

**Level of significance of difference:0.01 using independent t-test.

Levels of SI participation and academic achievement across ethnicities.

Data analyses were also used to find the utilization and effectiveness of SI services for students of differing ethnicities. A sample of 13 institutions was selected for analysis. The institutions were selected since: they had numerous SI's in place; had sufficiently rigorous data collection procedures; had transmitted their data to us in a timely fashion; they represented a cross section of institutions (3 two-year public, 4 four-year private and 6 four-year public). Of the 2,410 SI-participants in the study, 2,111 were Caucasian and 299 were non-Caucasian. Data permit the following observations. Students in each Non-Caucasian ethnicity used SI services at equal or higher rates than Caucasian students. Despite quartile ranking, Non-Caucasian SI-participating students earned higher grades than their non-participating counterparts (p<.01). Non-Caucasian SI-participating students received a lower percentage of D and F final course grades and withdrawals (p<.05) than their non-participating counterparts.

It is noteworthy that SI services appear to meet the needs of students with a wide range of previous levels of academic achievement and ethnicities within the college course, thus reducing the necessity for the institution to provide additional and separate tutorial and academic support programs.

Table 2a

Participation in SI By Differing Ethnicities: 1987(N=13 Institutions; 2,410 SI-Participants)

Caucasian	African American	Hispanic	Asian/Pacific	Native American
2,111	174	55	42	28

Table 2b

Effectiveness of SI With Differing Ethnicity and Levels of Previous Academic Achievement:

Spring and Fall 1987(N=13 Institutions, 299 Non-Caucasian Students)

Group Composition	Percent D,F & W		Mean Final Course Grade	
	SI	Non-SI	SI	Non-SI
All Minority	36%*	43%*	2.02**	1.55**
Lowest Quartile, Minority	Not collected	Not collected	1.87**	1.35**
Highest Quartile, Minority	Not collected	Not collected	2.64**	1.97**

*Level of Significance of difference: 0.05 using Chi-square test.

**Level of significance of difference:0.01 using independent t-test.

Appendix #12

Program Outcomes for FirstPrep

According to Robert Blanc, PhD., Director of the FirstPrep Program, comparative analysis of the United States Medical Licensure Examination (USMLE) national student data and the FirstPrep minority student data revealed the following observations:

- The average gain of 22 points from the pre-intervention USMLE score to the post-intervention USMLE score is statistically significant.
- Upon retest, the pass rate for minority students who participated in the FirstPrep program is higher than the pass rate for all students retaking the USMLE during the same period; and, the pass rate for the FirstPrep minority participants is statistically significant.

January 1994 Minority Student Progress Report
USMLE Step 1 Results Before and After Participation
In the FirstPrep Program

Student #	Ethnicity	Gender	Prior score	Post score	Gain
1	AfAm	F	130	142	12
2	AfAm	F	146	152	7
3	AfAm	F	173	147	14
4	AfAm	F	167	178	31
5	AfAm	F	160	175	15
6	AfAm	F	167	172	5
7	AfAm	F	168	181	23
8	AfAm	F	173	185	23
9	AfAm	M	129	170	41
10	AfAm	M	160	176	16
11	AfAm	M	173	194	18
12	Afam	M	154	180	39
13	AfAm	M	173	185	32
14	AfAm	M	146	172	26
15	AfAm	M	173	180	37
16	AfAm	M	173	194	24
Average	--	--	154.75	176.75	22.00

Passing Score = 176

Appendix #13

Program Outcomes for the Mathematics Workshop Program (MWP)

Comparison of Achievement by Subgroups

Table 1 provides a comparison of academic achievement among various subgroups of African American students enrolled in Mathematics 1A. Irrespective of which Academic Category (column 1 of table) is considered, the following trend emerges: when MWP students are compared to non-MWP students, within any given category, MWP students scored significantly higher than their non-MWP peers, even those non-MWP students from presumably stronger backgrounds. The most significant demonstration of this trend can be seen when the groups are examined in terms of their respective SAT Mathematics scores. Among both MWP and non-MWP students the probability of earning a grade of B-minus or better, has a statistically proven correlation with SAT-M scores; however, when MWP students with SAT-M scores in the lowest triad of the score distribution (i.e., scores between 200-460) were compared with non-MWP students with scores in the highest triad (i.e., scores between 560-800) there was no significant difference in the proportion of students in each group who earned final grades of B-minus or better. Overall, irrespective of the time period examined or the manner in which students were grouped, MWP students in any given enrollment category were two to three times more likely to earn grades at the higher score level than non-MWP students.

Table 1

Proportion of African American Students Earning Grades of B-Minus or Better in Mathematics 1A Among Selected Sub-Groups of Students:1973-77, 1978-82, and 1983-84

Academic Categories	Historical Control Group(1973-77)	MWP Parti-cipants (1978-82)	Non-MWP Participants (1978-82)	MWP Parti-cipants (1983-84)	Non-MWP Participants(1983-84)
All Afr. Amers Taking Math 1A	N=131 22%	N=188 54%	N=143 16%	N=43 58%	N=141 23%
Admissions Status					
Spec. Admits	(4/46)9%	(20/47)43%	(4/59)7%	(2/8)25%	(9/44)21%
Reg. Admits	(25/85)29%	(82/141)58%	(19/84)23%	(23/35)66%	(23/97)24%
EOP Status:					
EOP	(11/78)14%	(38-77)49%	3/41)7%	(5/9)56%	(5/36)14%
Non-EOP	(18-53)34%	(64/111)58%	(20/102)20%	(20/34)59%	(27/105)26%
College:					
Non-Engineer	(22/91)24%	(59/122)48%	(18/121)15%	(16/30)53%	(22/112)20%
Engineer	(7/40)18%	(43/66)65%	(5/22)23%	(9/13)69%	(10/29)34%
Sex:					
Male	(17/77)22%	(57/98)58%	(12/81)15%	(15/24)62%	(17/83)20%
Female	(12/54)22%	(45/90)50%	(11/62)18%	(10/19)53%	(15/58)26%
SAT-Math Triad[*]					
200-460	(8/43)19%	(17/56)30%	(6/47)13%	-	(3/37)8%
470-540	(7/35)20%	(29/54)54%	(6/35)17%	(8/17)47%	(7/32)22%
550-800	(11/41)27%	(46/65)71%	(10/42)24%	(16-22)73%	(18/58)31%

Note: The subgroups are not mutually exclusive (e.g., EOP students may also have been engineering majors)

[*] A tripartite division of students by SAT-Mathematics scores was created by dividing all students in the study into three groups of approximately equal (33.33%) proportions.

Persistence and Graduation

Table 2 illustrates the persistence and graduation rates of MWP and non-MWP UCB students who entered the school during the 1978-79 term. The proportion of MWP students who had earned degrees or who were still enrolled in a mathematics-based major by the spring 1985 semester was 65 percent. The comparable rate among non-MWP students who entered the university during this period was 41 percent, and the rate among African American students who entered the university in 1973 was 39 percent (both comparisons are significant at $p<0.001$). Of particular significance is the fact that the proportion of MWP persisters with SAT-M scores in the lowest triad was higher than the proportion of non-MWP persisters with scores in the highest triad. MWP students from the lowest triad group also persisted at rates higher than those of African American students in the historical control group with SAT-M scores in the top triad.

Table 2

Persistence and Graduation[*] Among African American Mathematics 1A-Takers, by Year and by MWP Membership

Academic Categories	Historical Control Group(1973-77)	MWP Participants (1978-79)	Non-MWP Participants (1978-79)
All Afr. Amers Taking Math 1A	N=547 39%	N=72 65%	N=209 41%
Admissions Status			
Spec. Admits	(79/279)27%	(14/24)58%	(30/91)33%
Reg. Admits	(113/250)53%	(33/48)69%	(55/118)46%
EOP Status:			
EOP	(118/356)33%	(24/40)60%	(45/119)38%
Non-EOP	(94/191)49%	(23/32)72%	(40/90)44%
College:			
Non-Engineer	(189/497)38%	(37/52)71%	(80/194)41%
Engineer	(23/50)46%	(10/20)50%	(5/15)33%
Sex:			
Male	(76/221)34%	(23/33)70%	(38/104)37%
Female	(136/326)42%	(24/39)62%	(47/105)45%
SAT-Math Triad[*]:			
200-460	(96/251)36%	(14/24)58%	(33/100)33%
470-540	(46/98)47%	(10/17)59%	(13/27)48%
550-800	(38/79)48%	(17/22)77%	(17/35)49%

Note: The subgroups are not mutually exclusive (e.g., EOP students may also have been engineering majors.)

[*] Refer to all students who had either graduated or were still enrolled at UCB as of the fall 1985 semester.

[**] A tripartite division of students by SAT-Mathematics scores was created by dividing all students in the study into three groups of approximately equal (33.33%) proportions. SAT scores are not available for all students in the sample.

Appendix #14

BARRON'S PROFILES OF AMERICAN COLLEGES

(16TH EDITION, 1988)

EXPLANATION:

The "College Admissions Selector Ratings" was designed to give applicants to 4 year colleges some idea of the competition that would be encountered when applying to a particular college.

The "College Admissions Selector" is an index that groups colleges according to degree of admissions competitiveness.

"The Selector is not a rating of colleges by academic standards or quality of education; it is rather attempt to describe , in general terms the situation a prospective student will meet when applying to college.

The criteria used to in determining the category for each college were:

- median entrance examination scores for the freshman class the SAT score used was derived bye average in the median verbal and median math scores The ACT score used was the median composite score.
- percentages of the freshmen scoring above 500 and above 600 on both the math and verbal sections of the SAT.
- percentage of freshmen scoring above 21 and above 25 on the ACT
- the percentage of freshmen who ranked in the upper fifth of their high school class and percentage who ranked in the upper 2/5ths
- minimum grade point average required for admission
- percentage of applicants to freshman class who were accepted.

MOST COMPETITIVE = 5

In general these colleges require high school rank in the top 10% to 20% and grade averages of A to B+. Median freshman test scores at these colleges are generally between 625 and 800 on the SAT and above 27 on the ACT. In addition many of these colleges admit only a small percentage of those who apply–usually fewer than one-third.

- Brown
- Cornell
- Harvard
- Tufts
- Michigan
- William & Mary
- Duke
- MIT
- U of Penn
- Columbia
- Georgetown
- John Hopkins
- Notre Dame

HIGHLY COMPETITIVE = 4

Colleges in this group look for students with grade averages of B+ to B and accept most of their students from the top 20% to 35% of the freshman class. Median freshman test scores at these colleges range from 575 to 625 on the SAT and from 26 to 27 on the ACT. These schools generally accept between one-third and one-half of their applicants.

- Boston College
- Columbia Gen. Studies
- Rutgers
- UVA
- SUNY Albany
- UCLA
- Wake Forest
- Boston University
- Emory
- Smith
- Berkeley
- U of Chicago
- Vanderbilt
- U of Illinois
- Barnard
- Oberlin
- Tulane
- Fairfield
- Union
- Villanova
- UNC

VERY COMPETITIVE = 3

The colleges in this category admit students whose averages are no less than B- and who rank in the top 35% to 50% of their graduating class. They report a median freshman test scores in the 535 to 575 range on the sat and from 23 to 25 on the act.
The schools in this category generally accept between one-half and three quarters of their applicants.

- SUNY
- Cal Schools
- Providence
- Adelphi
- Florida International
- Michigan State
- Texas A&M
- U of Mass
- Syracuse
- CCNY
- Wheaton
- Baylor
- Miami
- USC
- Creighton
- GWU

COMPETITIVE = 2

This category is a very broad one, covering colleges that generally have median freshman test scores between 450 and 525 on the SAT and between 19 and 22 on the ACT. Some of these colleges require that students have high school averages of B- or better, although others state a minimum of C+ or C. Generally these colleges prefer students in the top 50% to 65% of the graduating high school class and accept between 75% and 85% of their applicants.

- Cal State
- Minnesota
- U of Alabama
- Virginia State
- Davis
- Hunter
- Rutgers Newark
- SUNY Buffalo
- St Marys TX
- U of Delaware
- Indiana
- U Cal Sac
- Howard
- Spelman

LESS COMPETITIVE = 1

Included in this category are colleges with median freshman test scores below 450 on the SAT and below 19 on the ACT; some colleges that require entrance examinations but do not report median scores; and colleges that admit students with averages below C who rank in the top 65% of their graduating class. These colleges usually admit 85% percent of their applicants.

- Bennet College
- Florida A&M
- Lincoln
- Tougaloo
- Morgan State
- Bethune Cookman
- Delaware State
- Morehouse
- Md. Eastern Shore
- Xavier Ohio
- Fisk
- Hampton
- Talladega
- UDC
- Oakland

NONCOMPETITIVE = 0

The colleges in this category generally only require evidence of graduation from an accredited high school (although they may also require the completion of a certain number of high school units).

Some require that entrance examinations be taken for placement purposes only or only by graduates of unaccredited high schools or only by out-of-state students. In some cases. insufficient capacity may compel a college in this category to limit the number of students that are accepted generally, however, if a collage accepts all its applicants, it automatically falls in this category. Colleges are rated Noncompetitive if they admit all state residents, but have some requirements for nonresidents.

- Medgar Evers
- Grambling
- Southern

Appendix #15
Diagnostic and Admissions Tests

This appendix represents a description of diagnostic and admissions tests currently recommended by the Division of Disadvantaged Assistance in its 1994 Technical Assistance Manual to HCOP grantee applicants.

DIAGNOSTIC TESTS

COOPERATIVE MATHEMATICS TEST

Measures achievement in major mathematical content areas ranging from arithmetic to calculus.

IOWA SILENT READING TEST

To assess student's reading ability and comprehension. Grantees use levels II and III to plan preliminary education and retention programs.

IOWA TESTS OF EDUCATIONAL DEVELOPMENT

A high school achievement test battery to assess intellectual skills that are important in adult life and provide the basis for continued learning. May be useful to grantees planning preliminary educational programs for freshman and sophomore undergraduates.

MYERS BRIGGS TYPE INDICATOR

To assess individual personality dimensions.

NELSON-DENNY READING TEST

To assess student achievement and progress in vocabulary, comprehension, and reading rates. Used by grantees to plan preliminary education and retention programs. Other forms of the test available for use as pre- and post-tests.

STANFORD DIAGNOSTIC READING TEST

To assess the strengths and weaknesses of students' reading ability. Grantees use the 4th level to plan preliminary education and retention programs.

STRONG INTEREST INVENTORY

To compare an individual's interests with the interest of individuals already in a variety of occupations.

TEST ANXIETY PROFILE

To identify the types of academic situations that produce anxiety in the student.

WATSON-GLASER CRITICAL THINKING APPRAISAL

To assess critical thinking abilities. Evaluation of gifted and talented individuals.

ADMISSIONS TESTS

MEDICAL COLLEGE ADMISSION TEST (MCAT)

To assess understanding of science concepts and principles identified as prerequisite to the student and practice of medicine.

To evaluate basic analytical skills in the context of medically relevant problems and data.

To help admissions committees predict which of their applicants will perform adequately in the medical school curriculum.

DENTAL ADMISSION TEST (DAT)

To evaluate academic background and motor abilities required for dental education and practice.

VETERINARY COLLEGE ADMISSION TEST (VCAT)

To test academic achievement in areas necessary for the study of veterinary medicine.

OPTOMETRY ADMISSION TEST (OAT)

To measure general academic ability and comprehension of scientific information for admission to colleges of Optometry.

PHARMACY COLLEGE ADMISSION TEST (PCAT)

Assesses general levels of academic knowledge. One criterion for admission to most colleges of pharmacy.

GRADUATE RECORD EXAMINATION (GRE)

To qualify for admission into a graduate program.

ALLIED HEALTH PROFESSIONS ADMISSION TEST (AHPAT)

To qualify for admission to advanced level allied health studies.

DENTAL HYGIENE COLLEGE ADMISSION TEST (DHCAT)

To test academic achievement in areas necessary for the study of dental hygiene.